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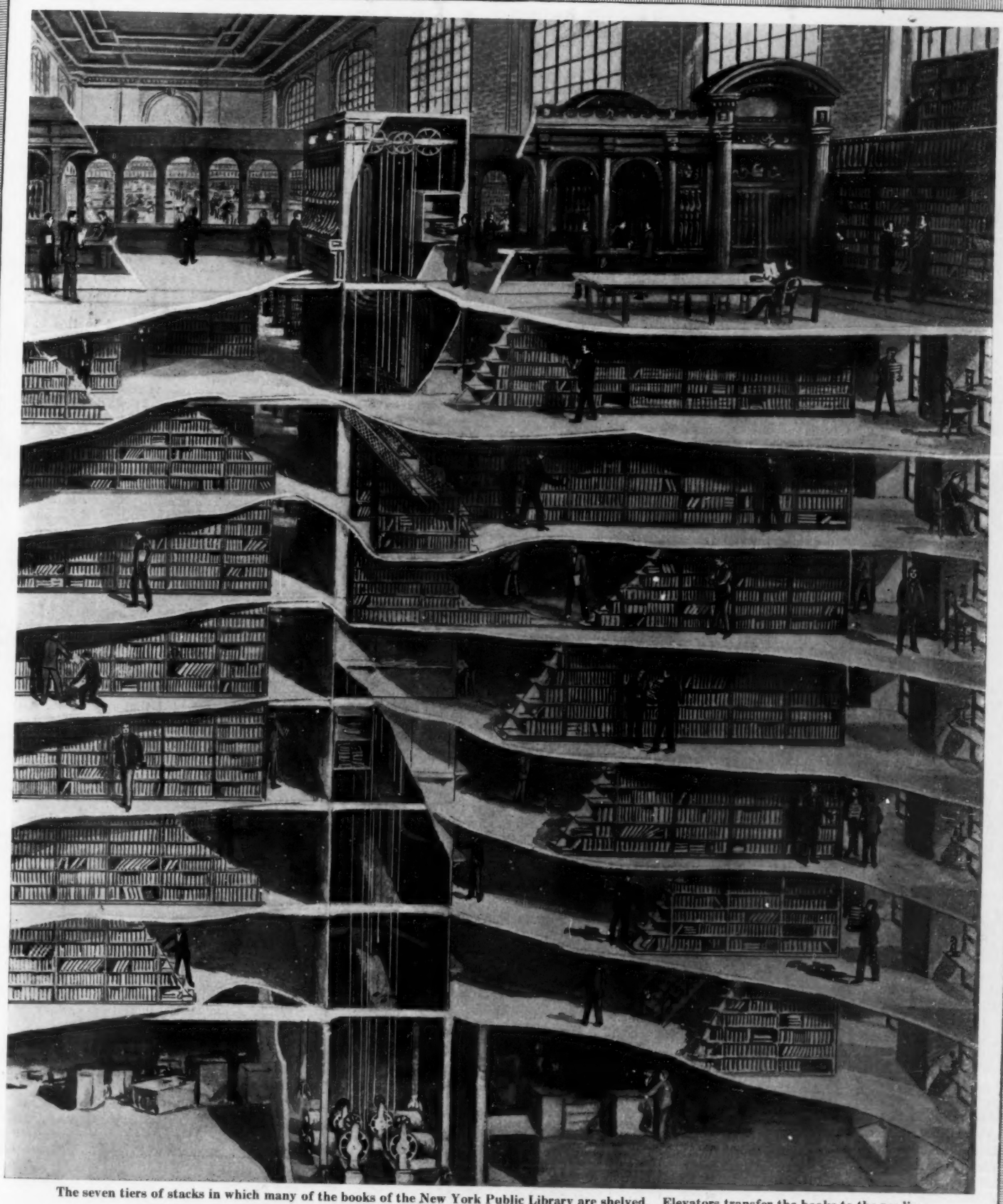

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A SECTIONAL VIEW OF THE NEW YORK PUBLIC LIBRARY.—[See page 527.]

SCIENTIFIC AMERICAN

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The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

The purpose of this journal is to record accurately and in simple terms, the world's progress in scientific knowledge and industrial achievement. It seeks to present this information in a form so readable and readily understood, as to set forth and emphasize the inherent charm and fascination of science.

Niagara Falls Again Threatened

ANY one who, after an absence of a few years, may have recently visited Niagara Falls, can scarcely fail to have noticed certain startling changes in the appearance of the great waterfall. Stretches of rock which once were covered now lie bare, and on the Canadian shore there are several hundred feet of reclaimed ground over which, before the opening of the Canadian power stations, there flowed a shallow but highly picturesque reach of tumbling water. In 1909, the chief of engineers of the United States army, in reporting upon the question of the depletion and defacement of the falls, said: "The falls have unquestionably been seriously injured by the diversion already made, and additional diversion now under way will add to the damage." Already the Bridal Veil is considerably lessened in volume, and west of Terrapin Rock, hundreds of feet on the brink of the American part of Horseshoe Fall are barely covered. Should further water be diverted from above the falls for power purposes, this stretch of shallow water will disappear, and the crest of the waterfall will be reduced to that extent.

These changes in the appearance of the falls are due to the fact that out of a total average flow of 222,400 cubic feet per second of Niagara River, 34,000 cubic feet per second has been diverted from the upper river, and is now flowing through the turbines and tunnels of the power companies instead of passing over the falls.

At the present time, a determined effort is being made by these companies to secure permission to divert immediately 22,000 cubic feet per second in addition to that which they are now using, making a total of 56,000 cubic feet per second, or 25 per cent of the average flow of Niagara, and 30 per cent of its ordinary low water flow. If the power companies are permitted to do this, the crest line of Niagara Falls, particularly on the shallower American side, will be so greatly reduced as to rob the stupendous spectacle of a great part of its dignity and beauty.

Senator Burton has presented a bill to Congress, which is designed to prevent any further diversion of water. The first Burton bill, passed by Congress in 1906, and extended in 1909, gave to the power companies all the water that they were at that time making preparations to use. The Waterways Treaty with Canada established a maximum limit of diversion from the river above the falls, of 56,000 cubic feet per second, purely for power purposes. Now the Burton bill expires June 29th, 1911, and acting upon the opportunity presented, the power companies claim that they must at once be allowed to use the full maximum limitation of 56,000 cubic feet per second, as determined by the treaty.

Senator Burton's joint resolution continues the provisions of the Burton bill during the life of the Canadian treaty. Should the bill be passed it will preserve the falls as they are, without stopping a single turbine in the present huge power houses, or hindering the operations of those vast electro-chemical and other industries which have sprung up at Niagara and in its near vicinity.

The power companies are seeking permission to use 68 per cent more water than at present. This additional development would yield to them ultimately an income of several millions of dollars per year. But it would do so at the cost of greatly damaging a stupendous natural spectacle, which is distinguished from other natural phenomena of the kind by the fact that it lies at the very doors of the millions of people with whom it is so deservedly popular.

There can be no doubt whatever that it is the wish of the people of the United States that Niagara Falls be forever left intact.

Automobile and Aeroplane Records

IT is a distinct tribute to the internal combustion motor that among vehicles the records for high speed should be held by the automobile, and that the aeroplane should be surpassing its own records at a rate which makes it possible that the speed record will ultimately pass from the earth into the air and be claimed by the racing aeroplane of the future.

With all due deference to the steam and the electric automobile, in each of which highly meritorious pioneer work was done, it will not be disputed that it was the advent of the gasoline engine which made the present perfected automobile possible; and when once the present essential standards of construction had been reached, it was merely a question of time and inclination as to when the present phenomenal racing speeds would be realized. At the opening of the present century, the highest authentic vehicle speed record was that of the railroad train, and it stood at about 90 miles per hour. We are aware that speeds of 100 miles an hour, and over, have been claimed; but investigation shows that the conditions of timing were not sufficiently accurate to guarantee acceptance. It is generally agreed among railway men that the highest railway speed lies between 90 and 100 miles per hour, with the probability of the lower limit being nearer the truth.

It should be understood that we are speaking of speed on steam railroads. On the electric railroad, the record stands far higher; for several years ago, in the celebrated German experiments with powerfully-motored electric cars, a limit of slightly over 131 miles per hour was reached on a stretch of straight and level track. In this case, the car was furnished with motors of over 2,000 horse-power.

In March of last year one of the powerful Benz racing cars, run by Oldfield, and equipped with engines of 200 horse-power, made a series of trials against time on that famous speedway of smooth sand in Florida, Ormond Beach, in which the mile was covered in 27.33 seconds, at a speed of 131.7 miles per hour; the kilometer in 17.04 seconds, equivalent to 131.3 miles per hour; and two miles in 55.87 seconds, at a speed of 128.6 miles per hour. These wonderful performances put the automobile on a par with the powerful German electric car, running on a regular railway track. Last month, however, the same Benz car, driven by Burman, covered the mile in 25.40 seconds, at a speed of 141.8 miles per hour; the kilometer in 15.88 seconds, at a speed of 140.9 miles per hour; and two miles in 51.28 seconds, which was equivalent to a speed of 140.4 miles per hour. Thus the automobile stands to-day as the fastest vehicle that man's ingenuity and skill have been able to produce.

Compared with the automobile, the aeroplane is yet in its youth, if not in its infancy. Nevertheless, in its construction, motive power and certainty of control, it is destined to undergo a development which will be even more rapid than that of the automobile. In this matter of speed, it is advancing even more rapidly than did its brother of the road and the racing track. Although the year is not yet six months old, records have been broken in rapid succession, and there is promise of even more remarkable performance before the year shall have closed. Thus, early in the year, Nieuport, driving a Nieuport monoplane of moderate power, covered the 100 kilometers in 59 minutes and 16 seconds, which is equivalent to a speed of 62.91 miles per hour. Later, on April 12th, LeBlanc, in a 100 horse-power Gnome-driven Bleriot, covered the same distance in 54 minutes, 55 3/5 seconds, which is equivalent to a speed of 67.88 miles per hour. Finally, Nieuport, in one of his Nieuport monoplanes, equipped with a Gnome motor of high power, flying over a closed 100-kilometer circuit, made the distance in 50 minutes and 4 seconds, which is equivalent to a speed of 74.46 miles per hour.

As to the future, it is probable that from 10 to 15 miles per hour will be added to the record before the close of the year. Bleriot is known to have built a racing monoplane which will be equipped with a Gnome motor of 140 horse-power; and since these machines will have the new flexible planes, there will be a rise in speed, due not merely to the greater power, but to the lessened resistance of the machine itself.

The success of Nieuport is significant; for he has evidently paid much attention to the reduction of head resistance and the elimination of skin friction—these being questions the importance of which has been too much neglected by the designers and builders of racing machines.

Pure and Applied Science

MUCH has been said and written on the value of pure science, and the inter-relation between it and applied science. There are enthusiasts, to whom practical application savors of desecration; somewhat more numerous are those extremists who see in "practical" results the only justification for the pursuit of pure science. It is true that these men usually lack the philosophical faculty which would force them to make their own position clear to themselves by examining the concepts lying at its foundation. What, after all, is practical? Is it not, in the last analysis, that which brings pleasure or alleviates pain?

To a certain type of mind, art brings pleasure, and pure science the most intense satisfaction. Unless such pleasures are bought at an undue cost to the community, art and pure science, then, carry their own justification. Added to this is the fact that they furnish the highest and most refined type of recreation to the appreciative, though not perhaps actively productive class, suffusing, like some unperceived but powerful undercurrent, higher ideals among their devotees. It would seem, therefore, that the advocates of pure science for science's sake have a strong case to plead, while the ground on which the "practical" extremist stands hardly passes the muster of close logical analysis.

Probably the majority of broad-minded, thinking men wisely take a median position. They, perhaps, do not side quite with the enthusiast for pure science, neither do they approve of an attitude of discouragement toward all scientific work for which they foresee no immediate practical application. They point out how the seemingly most abstruse scientific investigations have again and again grown to unexpected and most important useful application.

On the other hand, it has been urged that the pure scientist is apt to be a prophet after the event, who merely *analyzes* the scientific principles on which depends the working of the device *constructed* with intuitive wisdom by the practical man.

It cannot be denied that instances are plentiful in which practice has thus outstripped scientific theory; but this only shows that the relation between pure and applied science is of a mutual character—each stimulates and fertilizes the other. Nor is such analysis of an accomplished fact a fruitless addition to our knowledge. Perhaps the most remarkable illustration of this is the second law of thermodynamics, the recognition of which may be said to have been the immediate outcome of Carnot's reflections on heat engines. The knowledge of this law has not only placed in the hands of the engineer a sure guide for his technical work, but has proved a seemingly inexhaustible source of scientific conclusions of the utmost importance, throwing light on such varied phenomena as physical change of state, chemical dynamics, electro-chemistry, luminous radiation and so forth. We may well pause before we adjudge a greater importance to the purely technical considerations which originally prompted the classical "Reflections on the Motive Power of Heat," than to the deductions which pure science has drawn from the principles laid bare by Carnot, Clausius and Lord Kelvin. And there are many indications that the full scope of the second law, in some of its forms, is not yet clearly exposed. The attempts which have been made here and there to apply a principle of "increase of entropy" to phenomena of biology, sociology, economics and the like, may as yet be crude and lacking in that rigor which is demanded for a well-established scientific system, but they have been too numerous and have come from too eminent sources to fail to arouse our interest and awaken our hope for an ultimate clearing up of these fundamental questions also in the light of the great law.

"Ehrlich-Hata 606"

How It was Discovered

IN order to trace the complete history of the discovery of "Ehrlich-Hata 606," now known as Salvarsan, we must go back nearly thirty years, to the time when Weigert discovered that aniline dyes exhibit the same selective affinity for animal tissues that they show in regard to textile fibers. The new method of differentiating and studying the various elements of the body by means of dyes was enthusiastically taken up by Weigert's friend and cousin, Paul Ehrlich, who had long dabbled in dyes, with a recklessness little to the liking of his academic superiors and laboratory assistants. "The traces of Ehrlich's diligence are ineffaceable," one professor wrote.

In an article in *Die Umschau*, an abstract of which is here presented, Prof. Bechhold expresses the opinion that it is still too soon to estimate the full importance of these early experiments of the young physiologist, which exhibit remarkable inventive ingenuity and perfect scientific technique, and suggest numerous theoretical problems that will not be solved in a generation. For our present purpose we need consider only two facts established by these experiments—the effect of dyes on the blood, and the organism's need of oxygen. The blood consists of a colorless liquid, in which float various cells, of which the red and the white corpuscles are the most numerous. The red corpuscles are all alike, but the white corpuscles, or leucocytes, are of many varieties. Ehrlich found that acid, basic and neutral dyes were required, in different cases, to stain certain peculiar granules which are imbedded in the white corpuscles. From these investigations Ehrlich concluded that many elements of animal tissue possess specific affinities for particular dyes, and he was led to infer that they likewise possess specific affinities for poisons.

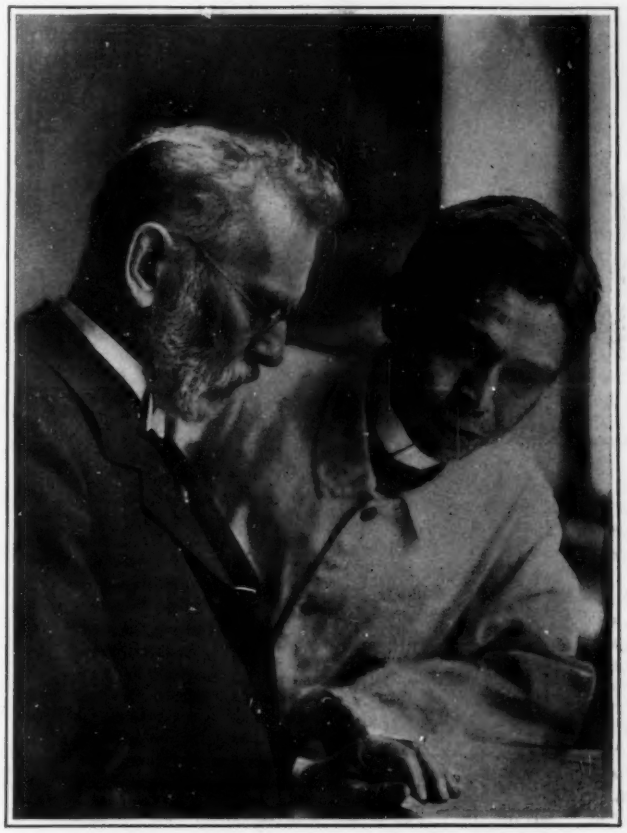
There are many non-poisonous dyes, of which methylene blue is peculiarly suitable for experimentation. If methylene blue is injected under the skin of a white mouse, all parts of the skin soon become deep blue. The color is most conspicuous in the tail, feet, eyelids and other hairless parts, but it shimmers everywhere through the thin white fur and appears in the urine, showing that the dye has traversed the entire circulation. If the mouse is killed, and thin sections of various organs are examined with the microscope, it is found that the color is not uniformly diffused, but is accumulated chiefly in certain cells and tissues, especially the nerve fibers and ganglia. Specific chemical reactions also come into play. Those cells which especially require oxygen supply their needs from the dyestuff, which is thus converted into a colorless compound. These cells, therefore, appear unstained, but they may turn blue on being exposed to the air. This research led Ehrlich to the discovery of the principle of distribution, according to which the effect of any given foodstuff or poison depends on the way in which it is distributed through the organism. For example, specific nerve poisons owe their deadly character and their potency in very small doses to their property of accumulating in the nerve cells.

These results suggested the possibility of destroying the germs of disease (bacilli and protozoa) within the body by the administration of poisons having so great specific affinity for the germs that nearly all of the poison accumulates in the germs, and only a very small portion is left to affect the cells of the diseased human or animal organism. Ehrlich even contemplated the possibility of discovering substances entirely innocuous to human and animal life, but acting as specific poisons toward disease germs.

Ehrlich's efforts to realize this idea were commenced about ten years ago. His first search was for a disease germ and an animal subject with which decisive experiments could be made without difficulty. He found the germ in *Trypanosoma*, a protozoon, or unicellular animal organism, characterized by a pear-shaped body and a long flexible tail. It is a little smaller than the human red blood corpuscle, and its presence in a drop of blood, examined with the microscope, is immediately revealed by helicoidal movement, accomplished with the aid of its whip-like tail. There are several species which produce various diseases, including the African horse and cattle plague or nagana, the caderas disease of horses in South America, the Indian cattle plague, or surra, the human "sleeping sickness," and others.

White mice were found to be excellent subjects for experiment, and susceptible to both surra and nagana. If a little blood containing trypanosomata is injected into the circulation of a mouse, the parasites will be found in a drop of blood drawn from the animal's tail on the second day after the inoculation, before any external symptoms of illness have appeared. On the third day the protozoa are very numerous, and death usually occurs on the third or fourth day.

In the hope of finding a remedy for the disease, Ehrlich inoculated thousands of mice with a great variety of substances. He showed a strong predilection for dyes, through which, he often asserted, lies the way to the discovery of new remedies. He exhibited an astonishing fertility in the production of new dyes, which is the more remarkable as he is a physician by profession and entirely self-taught in chemistry. By methods peculiar to himself he produces and studies new dyes without using balances, graduates or any apparatus except beakers and test tubes. His laboratory contains thousands of glasses filled with chemicals and scattered in apparently hopeless confusion. Once a pupil arranged the glasses systematically, and Ehrlich was unable to continue his work until the normal state of disorder had been restored. The floor, tables and chairs are stained with dyes, and the walls and doors are covered with chemical formulæ and notes.



PROF. EHRLICH AND HIS ASSISTANT, DR. HATA

For a long time Ehrlich was compelled to have his numerous chemical ideas worked out by friendly chemists and manufacturing firms, as his position as director of the Royal Institute of Experimental Therapeutics gave him neither room nor means for extensive chemical researches. Subsequently the foundation established by Frau Speyer gave him an independent laboratory and a body of assistants and pupils with whose aid his ideas could be developed rapidly.

Ehrlich obtained good results from several of the dyes employed in these experiments. A dye which he called trypan red proved especially poisonous to the trypanosomata, but only slightly poisonous to the infected mice. A single injection of the dye sufficed to save the life of a mouse which was at the point of death. Two other dyes, parafuchsine and trypan rose, exhibited similar properties. Hence Ehrlich had obtained the object of his search—a specific antidote which removes specific infection without injury, owing to its favorable "distribution."

In the course of these experiments Ehrlich discovered another biological law which determines the conditions of success in combating infection by chemical means. In some cases the cure effected by injection of trypan rose, etc., was permanent, but in others the trypanosmata reappeared sooner or later, showing that not all of them had been killed. A second injection of trypan rose failed to remove the remaining infection. Moreover, when mice inoculated with trypanosoma are treated with a series of small doses of trypan rose, instead of one large dose, the effect of each dose is less than that of the preceding. The trypanosomata acquire a tolerance for the poison, and, what is still more remarkable, they transmit this acquired character to their progeny. This discovery leads to the important conclusion that every trypanosoma in the body of the infected animal must be killed at once, in order to effect a cure by this method. If a single germ escapes death it acquires power to resist the action of the dye stuff and transmits this power to its descendants, and if the injections are multiplied and progressively increased a moment arrives when the accumulated poison becomes more deadly to the mouse than to the trypanosomata. These dyes, furthermore, proved less effective in rabbits and horses than in mice, and gave little promise of furnishing a sure cure for trypanosoma diseases.

Meanwhile Thomas and Breinl had employed arsenophenylglycin, a well-known organic compound of arsenic, with considerable success in the treatment of these diseases, especially the sleeping sickness. Robert Koch applied this compound, under the new name atoxyl, still more successfully to the treatment of sleeping sickness in Africa. These results led Ehrlich to combine arsenic with the substances which he had found effective. In this way he obtained brilliant success in experiments with animals. The treatment of human subjects presents great difficulties which have not yet been entirely overcome.

Ehrlich next began, with the aid of the Japanese biologist Hata, to extend his investigations to other disease germs, nearly related to trypanosoma. One of these is the protozoon *Spirochæta pallida* which Schandinn, a few years ago, identified as the germ of syphilis. Neither atoxyl nor the combination of atoxyl with mercury, proposed by Uhlenhuth and Salmon, proved sufficiently poisonous to *Spirochæta*, but Ehrlich was indefatigable in creating and testing new organic compounds of arsenic. At last he found in dioxydiamidoarsenobenzol, the six hundred and sixth of his preparations, a remedy which surpassed all expectations and which proved as successful in the treatment of human subjects as in experiments with animals. In the first eight months of its employment, the new remedy has effected nearly 5,000 rapid and apparently complete cures. One hypodermic injection suffices, and repeated doses are inadmissible for the reasons given above.

Artificial Leather

COINCIDENT with that rise in the price of meat of late years which falls so heavily on the domestic economy of the average household, we note a rise in the price of leather, which is even a severer burden on the workingman, since available substitutes for the latter product of the range are at once scarcer and more needed. It is encouraging, therefore, to learn that the efforts of the inventor to produce such substitutes have of late been crowned with remarkable success.

A prize of 5,000 francs has just been awarded by an agricultural committee of Terni to a Belgian inventor, Louis Gevaert, of Beveren-les-Audenarde, for an unusually superior artificial leather. The process, patented in 1907, and perfected by successive steps, consists in the more or less intimate impregnation of stout cotton cloth with tannic albuminoid substances. Shoes made of this are said to possess not only the resistance and elasticity of natural leather, but its durability of wear. Moreover, they are much cheaper, costing, including manufacture, only about 4 francs, and being sold at about 6 francs per pair.

American Ideas in British Battleships

The "Monarch"—a Modified "North Dakota"

We publish by the courtesy of the *Illustrated London News*, a deck view of the "Monarch," the latest and most powerful of the British dreadnoughts. The picture will possess unusual interest for Americans, inasmuch as it shows how strongly the ideas of our naval constructors have impressed themselves upon British design.

The original "Dreadnought" carried ten 12-inch guns in five turrets. In order to attain a heavy end-on fire, two of these turrets were placed in the wings of the ship, one on each broadside—an arrangement which, at the sacrifice of two guns in the broadside fire, enabled the ship to concentrate six guns ahead and the same number astern.

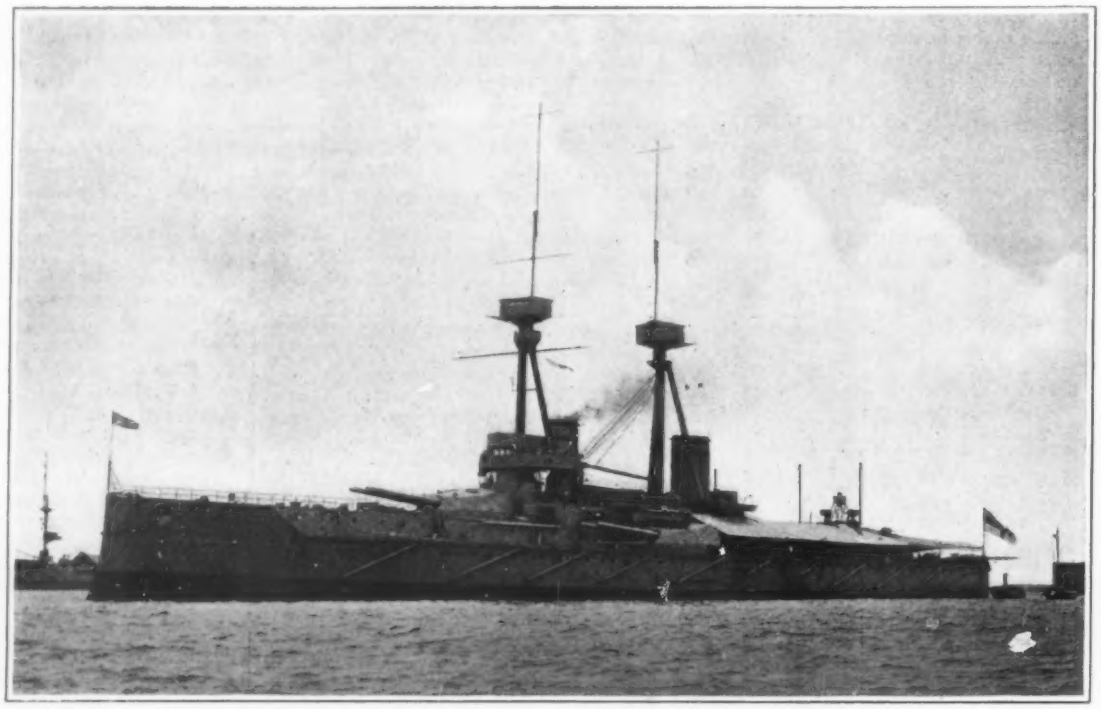
The officers of our own navy, both line and staff, have believed that future engagements will be fought almost entirely broadside to broadside, and that the time during which they will be fighting in the end-on position will represent but a small fraction of the total time of a naval battle. Hence, they have considered that the guns should be so placed as to enable all of them to be fired on either broadside, and that end-on fire, being of secondary importance, should be sacrificed, if necessary, to broadside fire.

Now because of the presence on deck of such obstructions as masts, smokestacks, conning tower, and deck houses, it is found that the only way to secure maximum broadside fire is to place all the turrets on the longitudinal axis of the ship. Furthermore, with a view to increasing end-on fire, our navy, after making tests at Indian Head proving ground, which showed that there would be no inconvenience from the blast of the guns, boldly arranged the forward and after pairs of turrets at different elevations, so that the guns of one turret could fire over the roof of the adjacent turret. This arrangement gave, in a ten-gun ship, a broadside fire of ten guns and an end-on fire of four guns. Now the British and Continental designers have hitherto looked with disfavor upon the American plan, considering that the ships were weak in end-on fire, and that the enormous blast of the upper pair of 12-inch guns must necessarily interfere with the work of the gun detachment in the turret below them. Hence, for six years past the foreign navies have been building battleships which, when the actual battle begins, will have from twenty per cent to about forty per cent of their big guns out of the game and, for the time being (which means for practically the whole of the time) useless.

Thus in the British navy the "Dreadnought" and the six battleships of the "Bellerophon" and "Saint Vincent" classes, during a broadside engagement, will be deprived of twenty per cent of their main armament. In the German navy, matters are even worse, since the four dreadnoughts of the "Nassau" class will be deprived of the service of thirty-three and a third per cent of their big guns. In the French navy, the six battleships of the "Danton" class will lose nearly forty per cent, and the later ships twenty per cent, of their battery power. Japan is no better off; about forty per cent of the big guns of the "Satsuma" and "Aki" will be idle during broadside fighting, and her "Kawachi" and "Setsu" will be without the services of thirty-three and a third per cent of the heavy guns.

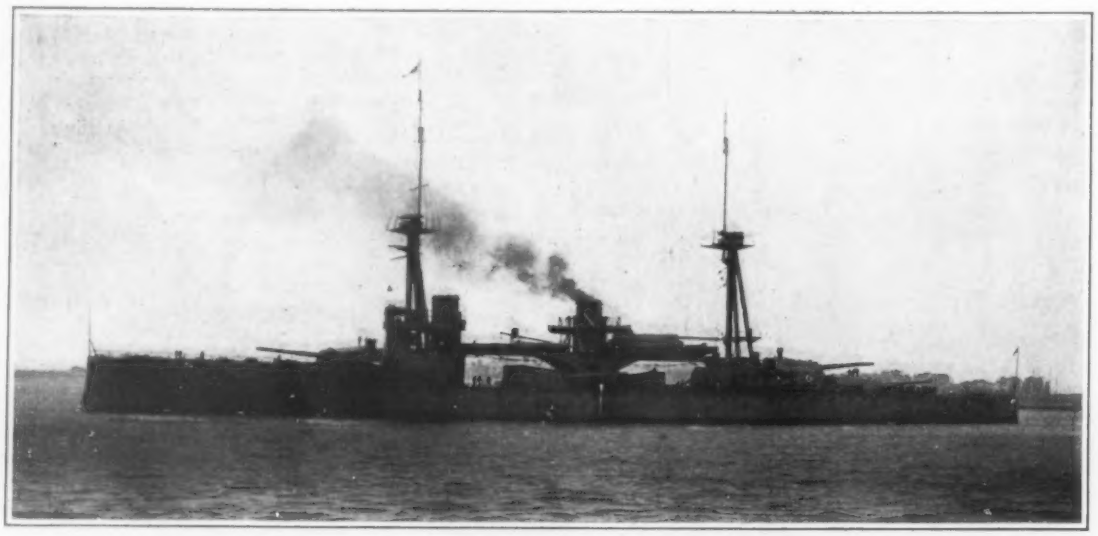
The above considerations show what a great advantage is held by our ships over vessels of equal gun power in the other navies of the world. The Japanese war showed clearly that the battles of the future will be fought broadside to broadside; and to the foresight and good judgment of the men who are responsible for the design of our battleships we owe the fact that in a fight of our fleet against one carrying an equal number of guns, our gunners will be able to fire from twenty to forty per cent more heavy projectiles in a given time than the enemy—always supposing that the speed of fire per gun is the same.

This is a handicap which can never be overcome; and at this late hour, foreign designers seem to be waking up to the seriousness of the situation. Practically all of them have frankly adopted the American principle of superposed turrets, placed on the longitudinal center line of the ship. The latest to fall into line are the British, and the picture of their first 13½-inch-gun battleship, the "Monarch," as herewith reproduced, shows how frankly they have adopted the American idea. The disposition of the guns is identical with that shown in our late illustration of the "New York" and "Texas." Forward of the conning tower are two turrets, the guns of the after turret firing above the roof of the turret in front. Then follow the two smokestacks and a super-structure with shelter screens within which are housed the ship's boats, to protect them from the blast of the guns. Immediately aft of the after smokestack is a turret, and aft of the engine-room hatch and super-structure are two turrets, arranged so that the forward guns may fire over the after turret.



British "Vanguard" of ten 12-inch guns. This is the original "Dreadnought" type, with a turret on each beam and three turrets on center line. In this arrangement the superstructure "masks" (interferes with) the off turret during a broadside engagement.

It is probable that in its battery arrangement this system will remain permanent in future construction. If the batteries are increased, it will probably be by the inclusion of more guns in each turret. If the displacement of the "Monarch" were increased to enable her to carry fourteen guns, the mounting of three guns in each of the two turrets forward and aft would enable her to fire six guns ahead and astern and at the same time deliver her whole fire of fourteen guns on either broadside.



The British "Neptune," the first to adopt the United States system of superposed firing. This is done in the two after turrets. In this class the midship turrets are placed "en echelon" (diagonally), giving a fire of six 12-inch guns ahead eight 12-inch guns astern, and all (ten) guns on the broadside.

AMERICAN SYSTEM OF GUN POSITIONS IN FOREIGN NAVIES

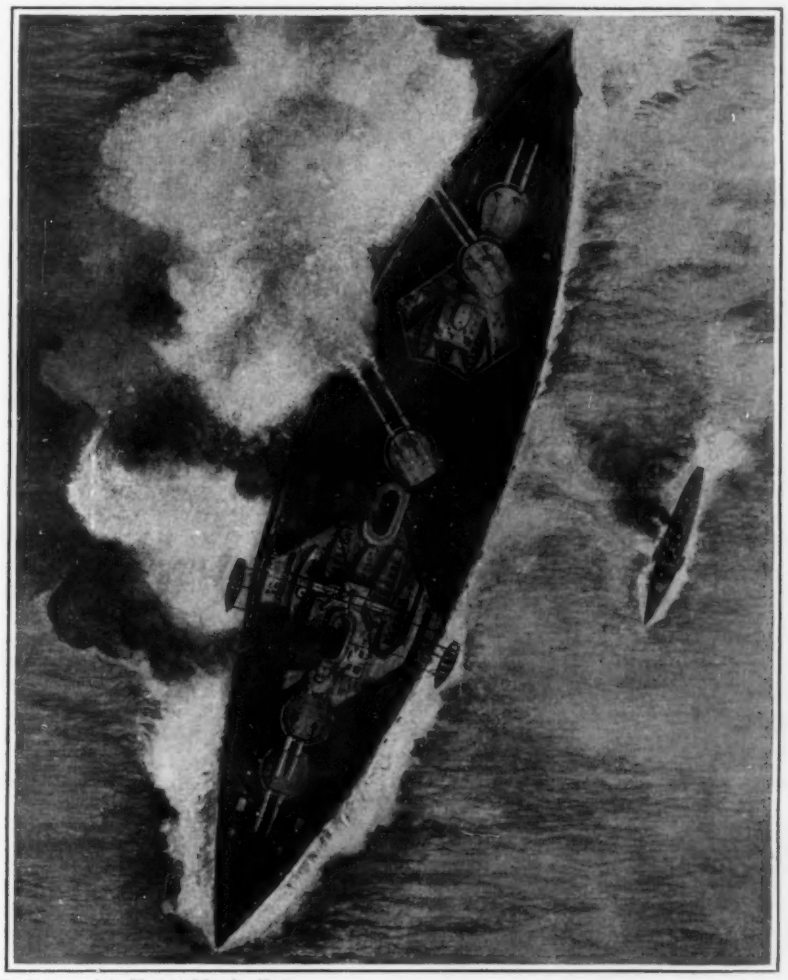
The Making of a Man

Among the many interesting "Foundations" in this country and abroad, that of Albert Kahn of Paris is at least novel, and might be called a plan for the making of a man. Mr. Kahn has in past years established such foundations in France, Germany, England, and other countries, and now the United States is to benefit by a similar act. A sum of money, about $2,500, is offered in this country as a sort of traveling fellowship for some citizen of the country whose natural qualifications as a scholar or investigator shall commend him to the trustees of the fund.

Selection of the fellow will be made by the trustees, who are Edward D. Adams, Nicholas Murray Butler, Charles W. Eliot, Henry Fairfield Osborn, and Charles D. Walcott, and they are to choose preferably professors in isolated southern and western institutions. The reason for this limitation is that the men in the larger cities have ample opportunity because of their residences for coming into contact with the larger things of the world, and are much better equipped for advancement. It is known that in the smaller institutions of learning there are men of advanced thought, of great capabilities, and fine intellect, who have no opportunity to come into contact with the great world and are therefore wasted. They are occasionally heard from in the world of art or letters, but never succeed in rising above their surroundings. It is to remedy this that the foundation has been established.

The trustees will select the fellow after careful investigation and will choose a man who is known among the educators of his neighborhood as having shown marked ability and promise in education; who has shown ability to enter into the spirit of such a fellowship, and a likelihood of considering his work as a preparation for the performance of higher duties in the institution and education of the youth of his country, rather than a vacation of a year with sufficient money to enjoy himself. The object of the foundation is really to select a man who shall be sent over the world to obtain the broadening influence of traveling in, to him, unknown lands, and on his return give to his students the benefit of his travels.

There are no restrictions upon him in this journey, except that his itinerary must be approved by the trustees and that his travel must be preferably in Europe, Egypt, India, China, Japan, Ceylon. It is also preferred by the trustees that the incumbent of the fellowship shall travel around the world, involving his absence from America for at least a year. After his itinerary is approved by the trustees he may begin his journey, taking his own time to visit the countries, and at the conclusion of his travels must submit a report giving results and impressions, which may be published. While it is likely that the man may be selected from some college or university, it is not necessarily the case.



By Courtesy of the Illustrated London News.

The latest British dreadnought "Monarch," carrying ten 13½-inch guns, has adopted the United States system of placing turrets, viz., two forward and two aft with guns superposed, and all turrets on the longitudinal center line.

The Restoration of Documents Charred by Fire

By George A. James

ONE of the irreparable losses of the San Francisco fire was the ignorant destruction of charred and scorched papers, recovered from safes, which, in all cases where records had not been reduced to ashes, could have been transcribed, or preserved.

My experience with over 20,000 documents of all kinds under treatment, without one failure in restoring the writing, assures me in stating that the writing of any document can be physically or chemically treated to develop the writing clearly enough for transcription, or preservation of the original document.

Most of the safes in the San Francisco fire had been subjected to great heat and for a long period, which, of course, no non-conductor could exclude from their contents. Where the safes had not been broken open by falling masses, I saw none that had not fulfilled all that could reasonably be demanded of them, and the contents showed that air had been almost entirely excluded. The volatile portions had been distilled, leaving the original documents in the shape of carbon. A large proportion of vaults did not prove as good, and in most cases the contents of these were partly or entirely consumed. In some cases the writing was plainly legible, but in the majority of papers there was no visible indication of the original writing. It was to be presumed that chemical methods that would act on the iron residue left from most of the inks would be serviceable, but by experience it was found that these often gave the most trouble, and reactions with iron gave little or no success.

I shall first describe methods for treating completely carbonized documents. My experience indicates that the only successful methods are more physical than chemical. No method of writing or printing fails to produce some physical effect on the paper, and this is accentuated by carbonizing. Methods that will produce a physical reaction in the carbon to augment this contrast will render possible the reading of the record. Thus the writing of graphite pencils was found easiest to read. This writing was not injured on charred or scorched documents, but remained as legible as such writing would appear on black paper. This quality was of great assistance in corroborating results in the restoration of other writing, as footings in most additions are first entered with pencil, so the work can be checked with perfectly clear marks.

Printing is easily read, as most people have observed when a printed paper is charred. This is caused by contrast of the carbon owing to the compression of the original paper under the presses. The only difficulty in reading this matter is in obtaining the right light, as most papers come through the carbonization crumpled. The same is true of typewriting, and in a lesser degree with carbon impressions.

As before stated, writing gave the most trouble, and the results of carbonization were remarkable. The chemical action of gases accounted for this. Adjacent sheets were entirely different, and parts of the same sheet would have writing plainly visible and writing most difficult to restore.

The handling of charred documents requires the utmost care. They are extremely fragile. A room should be chosen that can be guarded from drafts and which has abundant sunlight, so disposed that light can be obtained from various angles.

Books and piles were held together by the crumpling and irregularities caused by charring, and required patience and caution in separating. Spatulas made of thin celluloid were found best for this purpose. These were cut from sheets, such as are used for windows of automobiles, about an inch wide, all corners rounded off, and the edges made round and thin by scraping. Parts not having writing (such as that entering the binding, etc.) were cut away, to reduce the size of the sheet to be handled.

A sheet of paper, slightly larger than the charred document, was carefully brought under the record, and in this way the latter was transferred to the water trays. These trays were made of wood, with one end at a sharp angle, and lined with thin white oilcloth, folded to fit the tray, and tacked over the edges. These trays were two inches in depth, and made several inches larger than the papers to be handled.

When one side of the document had been read, a piece of oilcloth was brought under it, and while resting on this the document was drawn over the angular edge of the tray. By this means it could safely be reversed in the bath. After the transcription of the document had been made, it was placed on tissue paper, dried and attached by small strips of gummed paper, for preservation.

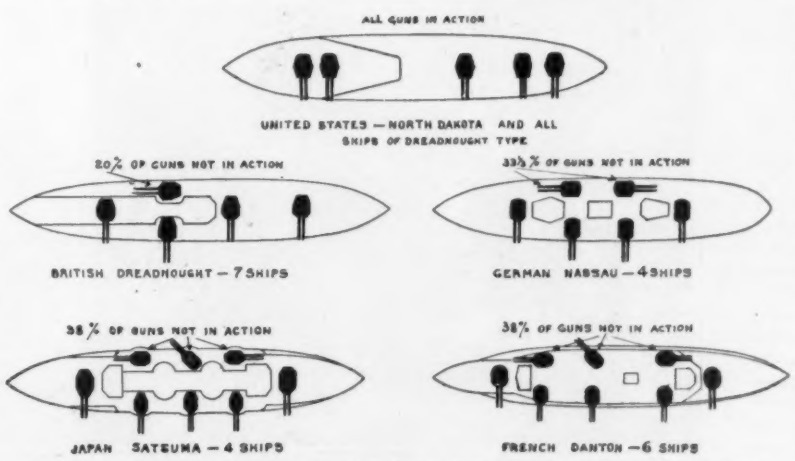
The wetting of the charred records served a triple purpose. Very often the entire document could be read at once, it overcame the difficulties of proper lighting, and lessened the fragility of the documents.

If the writing did not become legible in this treatment, the document was removed from the bath by means of the oilcloth, and brought on a thin board for convenient handling, to be treated by various chemicals. These were painted on with soft brushes.

First hydrogen peroxide was tried, then dilute sulphuric acid, and where these failed, alternate applications of oxalic acid and chloride of lime in saturated solution. As previously stated, one of these methods enabled the reading of over 20,000 documents, but some required great patience. Since this work was done, I have experimented and have very much improved on the above methods.

The record is first placed in the water bath, and then in a bath of gold chloride, such as is used for toning photographs. The result is a gradual reduction of gold in the metallic form on the carbon, and very little, if any, on the written matter. The contrast can be brought to almost any degree required, and a base can be formed for electro plating where a preservation of the document is necessary. The more dilute the gold bath is used the more uniform the deposition, but, of course, this is obtained at the expense of time. I suggest a slightly alkaline bath containing one-half gramme gold chloride to one liter of distilled water. This can be varied as experience suggests. The amount of gold required is compara-

(Continued on page 535.)


ALL GUNS IN ACTION
UNITED STATES — NORTH DAKOTA AND ALL SHIPS OF DREADNOUGHT TYPE
20% OF GUNS NOT IN ACTION
BRITISH DREADNOUGHT — 7 SHIPS
33⅓% OF GUNS NOT IN ACTION
GERMAN NASSAU — 4 SHIPS
38% OF GUNS NOT IN ACTION
JAPAN SATSUMA — 4 SHIPS
38% OF GUNS NOT IN ACTION
FRENCH DANTON — 6 SHIPS

Deck view of dreadnoughts, showing the greater broadside fire of United States ships, due to our center line system of placing the turrets.

AMERICAN SYSTEM OF GUN POSITIONS IN FOREIGN NAVIES

Automobile Novelties

New Things in America and Europe

Street Sweeping and Sprinkling with Gasoline Motor-driven Machines

By Frank C. Perkins

THE accompanying illustration shows a novel form of American motor-driven street cleaner and sprinkler of light construction having a working speed of four miles per hour.

It is claimed that this gasoline motor sweeper will do double the work at a cost of less than one-half that of a horse-hauled machine. Undoubtedly the subject of street cleaning is daily becoming more important from the fact that the mileage of paved streets throughout the country is increasing at a rate of over 1,000 miles per year. These streets must be cleaned and the public demands a more sanitary method of doing this work than has been the custom before. The combination motor-driven machine for sprinkling, sweeping and collecting the sweepings results in great economy and obviates the formation of clouds of dust which nearly always accompanies the operation of street cleaning by the old system.

This self-propelled machine has a speed when in regular commission of 4¼ miles per hour against 2½ miles per hour of dray teams. One man only is required to drive and operate this machine, which sprinkles, sweeps and picks up the sweepings all in one operation. Three round trips will clean the entire width of the average paved street and sweep to within a few inches of the curb on both sides of the street. Thus only the natural accumulation of dirt is left in the gutter, and this can be quickly and easily gathered by hand.

By means of this motor equipment a given section of pavement is cleaned, leaving all the sweepings at the center of this section in two piles on opposite sides of the street, where it can be quickly shoveled into wagons without the trouble of following the curb line along the entire length of the street, as is necessary with the old system.

It will be seen that the working parts are hooded in so as to prevent the dust from flying during the sweeping process. This is a very important sanitary improvement in the work of street cleaning. Only enough water is sprinkled on the pavement ahead of the sweeper to lay the dust. By this method there is said to be a reduction of 25 per cent in the cost of street cleaning as compared with any other method now in use in America.

The power of the machine is supplied by a two-cylinder opposed gasoline engine with planetary transmission and counter shaft. The motor-driven machine with sprinkler and inclosed revolving brush unquestionably represents a thoroughly rational solution of the problem of sanitary street sweeping.

Street sweeping and sprinkling with gasoline motor-driven machine.

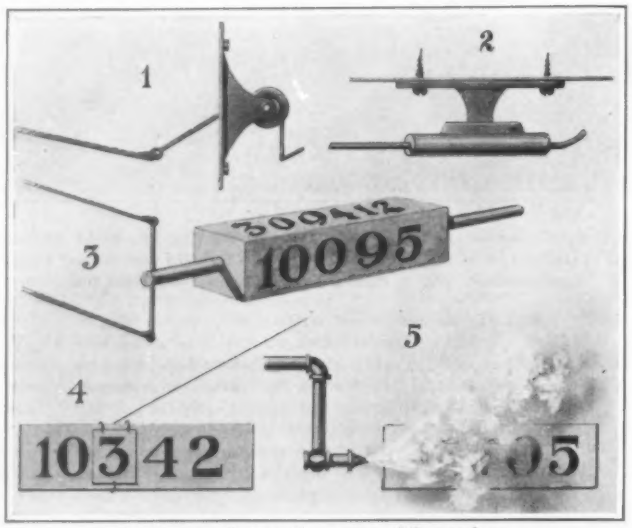
How Automobile Numbers are Concealed

By George Rice

IT may be questioned whether it is not a bad policy to expose fraud lest unscrupulous persons make unlawful use of the information. As a matter of fact we are inclined to think that the man who wishes to be dishonest is usually quite capable of inventing his own ingenious methods, and more good may be done by exposing such methods than by keeping them secret. In the accompanying illustration are pictured a number of devices invented by automobilists to alter or conceal their car license numbers at a second's notice, so as to avoid apprehension in case of accident or violation of the speed laws. One of the commonest practices, which does not require any illustration, is to oil the number plate so that it will collect dust in sufficient quantity to obliterate the figures stamped thereon. The methods here illustrated, however, call for the use of simple apparatus, which may be divided into three distinct classes. The first consists in dropping the number from its usual support and letting it drag along the surface of the road so that the numbers cannot be read. The second scheme consists in turning the plate so as to bring a new number into view or in covering one of the numerals with a new one so that the value of the number will be changed. The third system consists in discharging a cloud or spray of vapor to conceal the number.

Fig. 1 illustrates the apparatus employed for dropping the number. The number plate is hung on a pair of hooks which are held in such position as to retain the plate by means of a cord that runs to within easy reach of the chauffeur's seat. All that the chauffeur needs to do is to release the cord, when the hooks will swing downward and tip over, letting the number fall off. The number plate is then dragged along the ground by means of a wire attached to it until the car has reached a point of safety, when it may be restored to its original position. Fig. 2 shows another way of performing the same operation. In this case the number is supported on a pair of rods with their ends slightly upturned. The rods are carried in sleeves so that when they are drawn into the sleeves the number plate will be dropped off.

In Fig. 3 is shown a scheme borrowed from the revolving street car signs. The numbers are painted on three sides of a block, each side containing a different number. By means of a pair of cords attached to a cross arm, any one of the numbers may be brought into view at a moment's notice. The method of changing an individual figure of the number is shown in Fig. 4. One of the figures on the plate is concealed by a thin metal sheet bearing a different numeral. By operating the cord the hooks which hold this numeral are released, letting it drop off so as to expose the figure beneath, and thus alter the number. The system of obscuring the number may be accomplished as shown in Fig. 5, either with steam or with gasoline vapor from a cylinder arranged for the purpose. The valve controlling the spray is located within convenient reach of the chauffeur's seat so that he can hide the number whenever desired.



Some ways of concealing automobile numbers.

The Beff electric tricycle.

The Beff Electric Tricycle

By Jacques Boyer

AUTOMOBILES propelled by gasoline are rapidly superseding horse-drawn vehicles both for business and for touring. For use in crowded city streets, however, there is a growing demand, encouraged by municipal authorities and by public opinion, for light, noiseless and inodorous vehicles, offering the greatest possible security to pedestrians. In these respects electric vehicles are the best, and they should ultimately supplant all others in city streets. Every improvement in this line deserves attention. The new Beff electric tricycle has been adopted by two great Paris shops, "Le Printemps" and "Le Louvre," for their delivery service.

Hitherto, electric vehicles of all kinds have shown the massive construction of gasoline cars designed for bad roads, and their great dead weight has necessitated enormous expense for tires and current, as well as exaggerated dimensions. The Beff tricycle is designed to remedy these defects. Its most original feature is the system of control by means of the front wheel.

In the construction of motor tricycles the mounting of the motor presents serious difficulties. It is usually placed on the fork in front of the frame, but this arrangement necessitates the employment of heavy and bulky connecting mechanism, complicated in construction and operation.

The motor of the Beff tricycle is attached to the front wheel, as the photograph shows. The battery, which is concealed beneath the seat, consists of 22 accumulator cells, each of 2.2 volts, and has a capacity of 150 to 160 ampere hours, which suffices for a run of 30 or 40 miles at a speed of about 10 miles per hour, which is quite fast enough for city service.

The cost of charging the battery is about 70 cents. The one-seated delivery tricycle weighs about 1,100 pounds, and is capable of carrying 330 to 350 pounds, in addition to the driver. It involves little expense for tires, because of its remarkably light weight. Tricycles with seats for two and four persons are constructed on the same principle.

The Beff tricycle possesses an absolute certainty in operation, due to the great simplicity of its construction and the elimination of the differential and speed changer; remarkable facility of control, owing to its small dimensions and the fact that it is stopped and started by moving a single lever, so that its course can be abruptly arrested and turned, almost at right angles; and a stability that withstands all tests. The brake is applied instantly by means of a pedal, and the motor is reversed as quickly.

The Variable Speed Aeroplane

Some Ingenious Designs

AT the instigation of the Marquis de Dion, the French Journal *Auto* has offered prizes for aeroplanes which can travel over the same course with the most widely varying average speeds. The object of the competition is to promote safety in aviation, by landing at low speed. The greatest variation in speed appears to be possessed at present by the swiftest aeroplane, the 100 horse-power Blériot, which at Belmont Park started at about 50 miles and attained a maximum speed of nearly 70 miles per hour. The Bréguet aeroplane, however, can vary its speed greatly by changing the inclination of its sustaining surfaces, and will therefore have an advantage in the competition over more rapid machines with fixed wings, if it is permitted to land and adjust its wings between two courses. It is not always possible to find a safe landing place, and the danger of landing increases with the velocity. Nine-tenths of Blériot's numerous accidents occurred in landing. According to aeroplane constructors the minimum speed on striking the ground, with the motor stopped, is three-fourths of the starting velocity. For the swift Blériot this would be 37 miles per hour. The disastrous effect of striking a slight elevation of the ground at such speed, and with a vertical velocity of 10 or 12 feet per second, is easily imagined, and the danger increases with the size of the machine.

The development of the aeroplane depends mainly upon this factor of safety. It is claimed that there would be no inherent difficulty in combining 40 Bréguet biplanes to form a great airship which, though only half as long as a large dirigible, would be able to carry a useful load of 12 tons, or at least 100 passengers, with a liberal allowance of baggage. There is a great temptation to employ for landing, if possible, a water surface, which not only is level, but also forms an admirable buffer against vertical shock. Moreover, a large aeroplane can be mounted more conveniently on rigidly connected floats than on wheels and springs. With this construction it is necessary to rise from the water, and hence to start at the low speed at which the aerial propeller can drive the craft when afloat. In order to combine high maximum speed with low speed in starting and landing, and in emergencies, the inclination of the sustaining surfaces must be capable of variation, so that the speed can be varied greatly while the axis of the machine remains horizontal, and the propeller must be contrived to work with maximum efficiency and to use the full power of the motor, at all speeds of the aeroplane, for in starting, especially from a water surface, all available power must be employed. Some proposed solutions of this problem are discussed as follows in *Le Génie Civil*:

An aeroplane driven by a constant speed explosion motor exerts a maximum thrust when its blades have a definite inclination, which varies with the speed of the aeroplane. For the purpose of automatically adjusting the propeller blades to the angle of maximum thrust, at every speed, flexible blades are employed by Bréguet, a centrifugal regulator by Capon, and an electric regulator by Riester-Picard. The devices of Bréguet and Capon are simple, but only approximately solve the problem, while that of Riester-Picard is perfect in theory but complicated and delicate.

Bréguet's original flexible blade (Fig. 1) was formed of rubber cloth stretched over a series of flat steel springs, which were attached at one end to the rigid front edge of the blade; but the construction was afterward simplified by adopting a rigid blade, capable of motion around its edge, and controlled by a single spring. Bréguet has carried six persons with an aeroplane having a propeller of this type, driven by a 50 horse-power motor. Bréguet is now experimenting with a three-bladed propeller (Fig. 2). Each blade is attached to the shaft by an arm, and is free to oscillate, under the control of springs, about three axes. At starting the blade turns on its axis of figure (*AB*) so as to strike the air at a very small angle and produce a maximum thrust. As the aeroplane gains speed the blade returns toward its normal position, and thenceforth automatically adapts its inclination approximately to the speed of the aeroplane. The blade protects itself against the irregularities of the motor by turning slightly in its plane of rotation about its point of attachment (*A*) to the arm, and also by rocking forward and backward, with its arm, about the axis *XX*.

Capon's system of varying the inclination of the propeller blades by means of a centrifugal regulator is very simple in theory and construction; but the inclination of the blades is controlled entirely by the speed of the motor, and is not affected by the speed of the aeroplane, unless the former is made to depend upon the latter by another regulator. This is not the usual practice; nor is it desirable, as the efficiency of an explosion motor is impaired by deviation from its normal speed.

In Riester-Picard's system (Fig. 3) each of the two blades *F* of the propeller is attached to an arm *b*, which can be turned on its axis, in the ball bearing *f*, by the crank *m*. This crank is turned by the rod *a*, which abuts against a sliding piece *g* on the hub *h*. This sliding piece turns with the hub and is moved along it by the collar *j*, which is pressed outward (to the left in the figure) by the spring *e*, and drawn inward by the lever *P*. One end of this lever is pivoted at *o*, while the other end *p* is subjected to a varying pull communicated to it by the flexible transmission *r* either from the hand lever *L* or from the soft iron core *t* of the sucking coil *S*. The shaft of the propeller turns in the ball bearings *u* and *v*, and the end bearing *v* receives the total thrust by the pressure of the air on the blades. This end bearing *v* rests against a compressible vessel *z*, filled with oil and connected with a manometer which indicates the thrust of the propeller at every instant. (The oil vessel and manometer are shown in Fig. 5.) Hence the pilot, by moving the lever *L*, can always give the propeller blades that inclination which will produce the maximum thrust, as indicated by the manometer.

The same result can be produced automatically by means of an electric regulator. The oil vessel *z* communicates with a small cylinder containing a spring piston. An electric current is caused to traverse the sucking coil *S*, so that the core *b* tends to move toward the right and to increase the inclination of the propeller blades and the thrust of the propeller. When the maximum thrust has been obtained, however, the spring piston is forced to its extreme position, in which a finger attached to the piston breaks the circuit of the sucking coil. The inclination of the blades and the thrust of the propeller are then promptly diminished by the recoil of the spring *e*. This diminishes the pressure in the oil vessel and cylinder, so that the piston recoils and re-establishes the circuit, which is quickly broken again by a repetition of the action described above. Hence the sucking coil is traversed by an intermittent current of short period which keeps the thrust practically at its maximum value.

The propellers of the dirigible balloon "Clement-Bayard," which have given perfect satisfaction, possess some of the features described above.

Riester-Picard has also designed an aeroplane in which the inclination of the sustaining surfaces can be varied. This aeroplane (Fig. 4) is a sort of double biplane, having a pair of elevating planes *E* at the bow, and a direction rudder *G* at the stern. The two biplanes are connected by a braced girder *P*, from which the machinery is suspended. The four slightly

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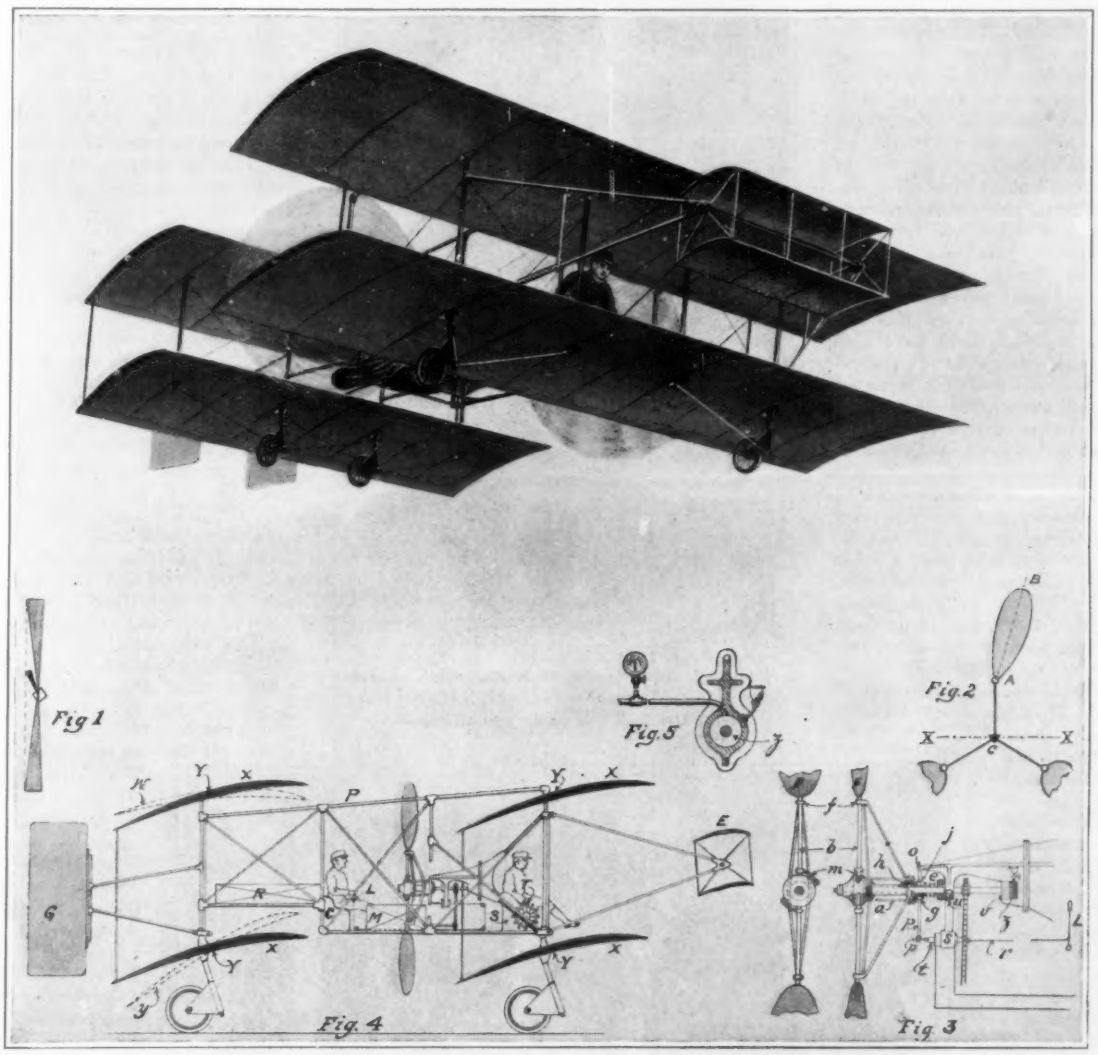


Fig. 1.—Bréguet's propeller with flexible blades. Fig. 2.—Bréguet's propeller with adjustable blades. Fig. 3.—Riester-Picard's propeller with self-adjusting blades. Fig. 4.—Riester-Picard's variable speed aeroplane.

NEW IDEAS IN AEROPLANE DESIGN

The Seventeen-year Locust or Periodical Cicada

The Two Races and When They Appear

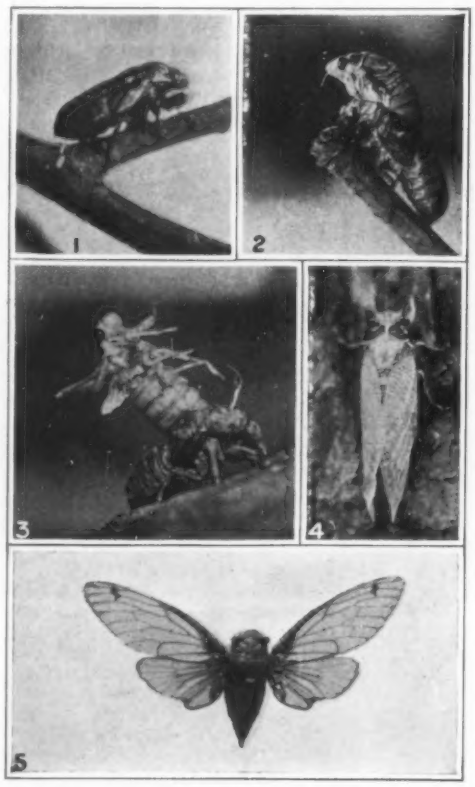
By Dr. L. O. Howard, Chief of the Division of Entomology, Department of Agriculture

ONE of the most interesting insects in the world is the American periodical Cicada, or so-called seventeen-year locust. Every seventeen years in given localities in the Northern States, and every thirteen years in given localities in the Southern States, this sizable but rather frail insect comes out of the ground in great numbers—sometimes in incredible numbers—and for a few weeks pierces the air with its shrilling. It sometimes happens that in certain localities it will appear at more frequent intervals. Thus in 1902 it appeared in parts of Maryland, New Jersey and Eastern Pennsylvania, and in the present year (1911) it will again appear in the same general region. But this does not mean that those which will appear this year are the children of those that laid eggs in 1902; they belong to a different brood, and their immediate parents were flying and singing and laying their eggs in 1894, while the children of the 1902 brood will not issue as adults until 1919.

There are many of these so-called broods, all accurately mapped, and their appearance from time to time can be predicted with certainty. The seventeen-year brood of the present year, for example, running from North Carolina up to Albany, New York, and occurring also in Connecticut, has been reported every seventeen years since 1724 in Connecticut, and in New Jersey since 1775. Many changes have occurred in the 187 years elapsing between 1724 and 1911. Many a generation of Cicada larvæ have gone into the ground for their long years of larval life, emerging at last to the surface only to find in many instances that in the seventeen years a house or a paved street or possibly a whole town has covered the surface.

There are thus two distinct races of the periodical Cicada. The northern, or seventeen-year race stays under ground seventeen years, except for a few weeks. The southern, or thirteen-year race occupies only thirteen years in its subterranean growth. And occasionally, as will happen the present year, a brood of each race will make its appearance. On the whole, for one reason or another, most of the great broods are growing smaller. This is due in part to the gradual change in the face of the country through civilization, and partly, in our cities, to the work of the English sparrow now become so annoyingly abundant. Exact records of the appearances of the Cicada have been kept for many years, and it is therefore possible to predict their appearances with exactitude for many years to come. In 1912 they will come out over most of Iowa; in 1913 in Southwestern Iowa and southward through Eastern Kansas and Western Missouri into the Indian Territory and possibly into Texas. In 1914 a compact brood will appear all through Eastern Ohio and over most of West Virginia, and in 1915 a scattering brood will be found through Wisconsin, Michigan, Illinois, Indiana, Ohio, West Virginia and south.

The alarm always caused by the appearance or announced appearance of this insect is largely unjustified. They take practically no food, and injure trees only by the unfortunate way in which they lay their eggs. They begin to come out about the end of May or early in June, and are active as adult Cicadas for four or five weeks. After mating, the female lays her eggs by working her strong ovipositor into tender twigs of many different kinds of trees, inserting her eggs under the bark and in the sapwood in a line along the axis of the twig.



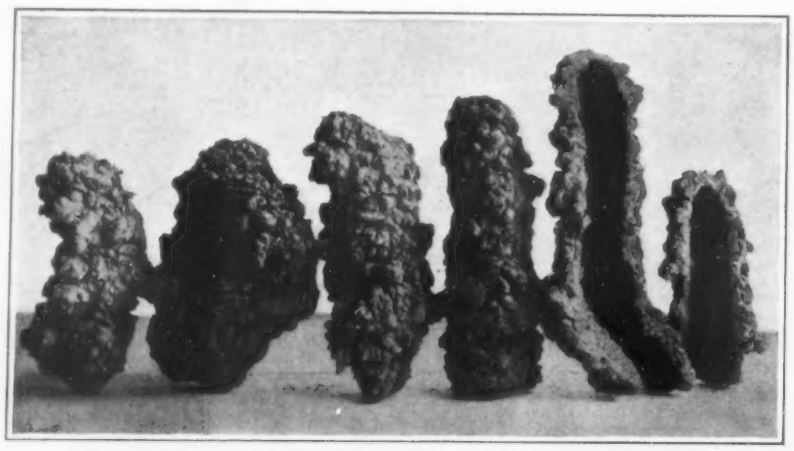
1. Pupa. 2. Adult issuing from pupa shell. 3. Later step in the same process. 4. Adult just after leaving pupa shell. 5. Mature adult cicada.

Twigs thus attacked usually die, and where the Cicada is numerous these terminal twigs with dead leaves are frequently so abundant as to make it appear as if a patch of woodland had been seriously injured. The eggs begin to hatch late in July, and the active little larvæ drop to the ground and burrow beneath the surface, where they remain until the end of May of the seventeenth year thereafter. These larvæ are not grub-like, but are active, four-legged creatures, and burrow readily through the soil by means of enlarged forelegs. They do not seem to injure the roots of plants, but to derive their sustenance from the organic matter contained in soil moisture.

In the late spring of the seventeenth year, they have passed through their last molt and have become pupæ, but in this stage they are as active as before. Sometimes reaching the surface of the soil, they will build little cones or chimneys of earth above the surface of the soil, building upward continually for several weeks before the time of issuing. Why they should build these chimneys or turrets or huts, as they have been called, has been a puzzling matter for the people who have written about it. They seem to be made when the soil is shallow or when there is some unusual warmth which brings the pupæ to the surface in advance of the normal time and also sometimes when the soil is excessively moist. The conditions, in other words, must be somewhat abnormal or the chimneys are not constructed.

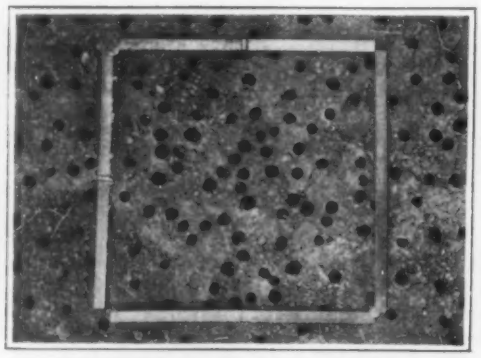
When the proper time arrives, the pupæ leave the ground almost with a rush. They all come out nearly together and scramble for some tree trunk or fence or bush. On such base they climb upward for a considerable distance and then seize hold firmly and rest. This scramble from the ground begins always just at sundown and continues until nine or ten o'clock in the evening. About an hour after they have risen and fixed themselves, the skin begins to burst along the back of the thorax and the adult Cicada slowly crawls out. In from twenty minutes to an hour or more the issuance is complete, and the newly issued adult, white in color with red eyes, clings either to the pupa shell or to the bark of the tree or to the other object upon which the pupa may be fixed, and gradually the wings expand and dry, and during the night the dark brownish color of the insect becomes evident.

The Cicada has not many natural specific enemies, and this is quite to be expected from its rare appearances. Nevertheless, many birds feed upon it with avidity, and the English sparrow, rather contrary to its normal habits, seems to begin a prolonged feasting whenever the Cicada comes. So generally are the Cicadas destroyed in the neighborhood of cities by this city nuisance that each year the broods have become smaller since this sparrow was brought to this country. One of the natural enemies is the largest of the digger wasps, *Sphecius speciosus*. This wasp stores its burrows with Cicadas. The periodical Cicada as a rule appears too



Earth cases of larvæ.

Earth tubes of larvæ coming to the surface too soon.



Holes in the ground from which cicadas have issued.

Pupa cases of cicada.

A PERIODICAL INSECT PEST

early for the wasp, which finds the bulk of its prey in the common dog-day harvest fly that comes out after the seventeen-year locust has disappeared, but many of the late-flying seventeen-year Cicadas are captured by the earliest of the wasps to issue, are stung by them and carried away and packed in the long wasp burrows beneath the ground.

The eggs of the Cicada are preyed upon by certain mites, and there is a little internal parasite which destroys them as well.

It sometimes happens that orchards located on cleared lands or in the vicinity of standing forests are very seriously injured by the Cicadas laying their eggs; but on the whole they do little damage. Where damage of this kind is feared, the remedies consist in destroying the pupæ as they arise from the ground and while they are more or less torpid and sluggish. A very strong solution of kerosene emulsion has also been used with excellent effect. It should be sprayed over the pupæ and newly formed adults in the early evening. A heavy coat of whitewash on the trees will keep them away to some extent when there are other trees in the neighborhood. Bordeaux mixture seems to have some effect of the same kind. Owners of young orchards, forewarned of the coming of a brood of Cicadas, should neglect all pruning operations during the winter and spring in order that their trees may be pruned for them by the Cicadas, thus distributing the damage over a larger surface. Another precaution when a Cicada year is expected is to defer the planting of orchards, especially in the vicinity of old forest land, until the danger is past.

Forests and Water Supply

By Russell L. Dunn

THE source of all the water on the land surface of the earth and beneath it is the water vapor diffused or held in solution in the atmosphere. The condensation of the water vapor results in the change of the water from the gaseous to the liquid state, in which condition it is heavier than the atmosphere, and gravity operating it falls to the land surface, arriving there, dependent on the temperature and relative dryness of the atmosphere it falls through, either in liquid form as rain or in solid form as snow.

That portion of the water precipitated on the land surface which runs off from the surface by gravity to the sea is "water supply," and the other portion is "water waste." The latter includes water which is evaporated directly back into the atmosphere from the surface of snow, water which is evaporated directly back into the atmosphere from the land surface, water which is evaporated back into the atmosphere indirectly from the land surface passing on the way through the leaves of trees and vegetation generally, and water which becomes fixed in the structure of vegetation, the trunks of trees particularly. Water supply includes water which runs off the land surface by gravity without passing through the land beneath the surface and water which passing first beneath the surface subsequently comes to the surface by gravity and then runs off of the surface by gravity.

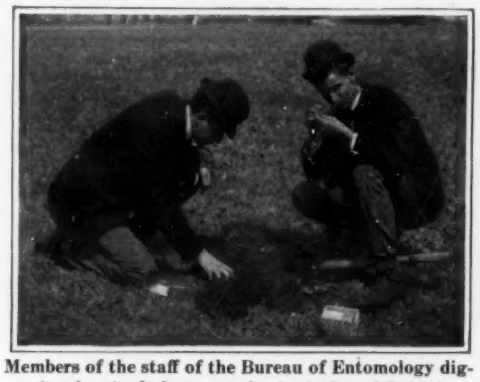
It has been maintained that the forestation of land in comparison with its non-forestation increases the quantity of "water supply" and decreases the quantity of "water waste."

Consider first the case of water precipitation which comes on to the land surface as rain. Obviously, if rain falls on impervious rock or earth surface it runs off from that surface undiminished in quantity, substantially all of it becoming water supply except the quantity evaporated directly from the surface of the water as it runs off by gravity. On the other hand, if the rain falls on a pervious surface, that is a surface composed of rock or soil particles with voids between the particles, the water seeps or percolates into the surface by gravity until it has filled the voids and thereby made an impervious surface over which any additional precipitation of water runs off precisely as it would from an impervious rock surface.

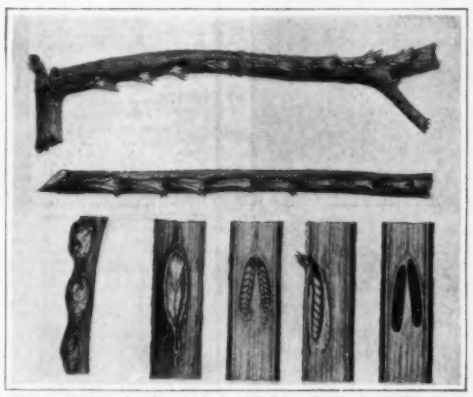
Obviously, the forestation or non-forestation of the pervious land surface does not determine the quantity of water which enters that surface. The quantity of water entering the land is determined by the cubic space quantity of the voids between the soil particles. That is, no more water enters the land when it is forested than when it is not forested. Also, the quantity of that part of the water supply which is run off of water by gravity without entering the land at all is the same quantity whether the land is forested or is not forested.

But, of the quantity of water which percolates into the soil voids from the precipitation, only that portion is water supply which reappears from the discharge of the voids by gravity, the remainder being water waste. The question of forests increasing the water supply thus becomes limited down to the proposition of whether or not the voids in the soil discharge more water by gravity through springs back to the surface when the land is forested than when it is not forested.

As between land forested and land not forested, the larger water waste quantity made by direct evaporation from the land surface is from land not forested. The shade of the forest keeps the surface of the land beneath it from receiving as many heat units from the sun's direct rays as the unprotected surface would receive. But the heat units which the land surface shaded by the forest does not receive directly are nevertheless received indirectly by the land surface through the leaves of the forest trees. The heat units of the sun's rays are neither more nor less in quantity by reason of the forested condition of the land, but are the same quantity. Those heat units



Members of the staff of the Bureau of Entomology digging for cicada larvæ on the Agricultural Department grounds at Washington.



Eggs of the cicada as deposited in the twigs of trees.

Cicadas laying their eggs in twigs and twigs showing egg-punctures.

PHASES OF THE 17-YEAR LOCUST'S LIFE

that impinge directly on the land surface become conserved into work which can be expressed in terms of water evaporated directly from the soil voids. The heat units that impinge on the tree leaves become conserved into work which can be expressed in terms of water evaporated from the tree leaves and in terms of the water fixed into the tree structure, both quantities of water being obtained from the soil voids. The total quantity of water waste evaporated from the soil voids bears a direct relation to the number of heat units received from the sun, the more heat units the more water evaporated, and it is quite obvious that whether these heat units become conserved into work directly in the soil voids where there is no forest cover, or indirectly through the tree leaves where there is forest cover, the total quantity of work conserved from heat and expressed in terms of water removed from the soil voids is the same.

Obviously, if the quantity of water percolating into the soil voids is the same quantity whether there be forest on the land or no forest, and the quantity of water waste deducted from it by the sun's heat units conserved into work is the same quantity whether there be forest on the land or no forest, then the quantity of water supply which remains after the deduction of the water waste to reappear through the gravity discharge of the soil voids is the same quantity whether there be forest on the land or no forest.

Consider now the case of water precipitation which comes on to the land surface as snow. After the snow has melted and become water the preceding analysis applies. The forestation or non-forestation of the land does not affect the quantity of water supply from melted snow water.

Before the snow melts, during the period of temperature below the melting point of snow, there is a water waste from the snow by direct evaporation from it, but, as the temperature when below the snow melting point is, if different at all, higher outside of the forest shelter than under it, the water waste from unmelted snow may be a larger quantity where the land is not forested than where it is forested. The difference of quantity of water waste from unmelted snow outside of forest cover and unmelted snow within forest cover is, however, so relatively small that the effect of the forest is practically nothing on the quantity of water supply provided from snow precipitation.

It has been maintained that the forestation of land in comparison with its non-forestation retards the melting of snow, that snow melts slower where it is precipitated on forested land than on non-forested land, and that therefore flood stages of run off of water from melting snow are not as high where the melting snow is under forest cover as where the melting snow has no forest cover.

The melting of snow bears a direct relation to the heat units which the snow receives. Where there is no forest cover, the heat units reach the surface of the snow, and, absorbed by it, become conserved into work expressed in terms of water melted from snow. As the water is produced at the surface of the snow, it leaves the surface by gravity, exposing an unmelted surface of snow, which in turn melts and passes from the surface by gravity. But all of the melting time there is only one surface of the snow, the top, receiving heat units and melting.

Where there is forest cover a less number of heat units reach the surface of the snow, the top, but the bottom of the snow also receives heat units and melts. The heat units which reach the bottom of the snow are heat units collected by the tree leaves and carried by the descending sap to the tree roots, where they become released in effecting chemical changes in absorbing plant food from the soil along with their water carrier. The released heat units raise the temperature of the soil above the melting point of snow where the two are in contact, and the snow melts on the surfaces of contact, the water produced passing away from the snow by gravity leaves an unmelted surface against the warmed soil and the process is repeated.

In the forest during the period of greatest rate of growth of the trees the heat units released and becoming sensible heat in the soil are a larger quantity than the difference between heat unit quantities received by the top surface of the snow where there is no forest cover and where there is forest cover. The increase is due to the conservation of heat from chemical combination in the soil in the process of digestion of plant food. The increase is not a large quantity, but it is sufficient to cause the melting of snow from beneath a forest cover at a more rapid rate than when there is no forest cover. This phenomenon is a matter of very ordinary observation. The observed fact agrees with the conclusion of a deductive analysis concerning it. Instead of the foresting of land retarding the melting of snow as compared with the melting of snow on non-forested land the fact is the reverse, the forest cover of land accelerating the melting of snow beneath it and thereby causing higher flood stages of run-off water than the run-off from melting snow where there is no forest.

Let us study two fields of similar surface lying contiguous, one of the two being planted with a clover, for example, alfalfa, the other being clear of vegetation of any kind. The snow cover will become melted from the alfalfa field sooner than from the barren field. The alfalfa will begin growing before the snow is entirely melted, and will disengage heat in growing which will start melting the snow at the bottom. Both fields receiving the same heat on the top surface of the covering snow would become cleared by the melting of the snow at the same time except for the heat received by the snow on the alfalfa field at its bottom surface accelerating the rate of snow melting.

Correspondence

The American Merchant Marine

To the Editor of the SCIENTIFIC AMERICAN:

I have read with much interest the articles in your issue of April 29th on the American merchant marine.

Having formed some decided opinions on the subject, I avail myself of the invitation which you extend to all, and herewith submit them for your criticism and publication.

My opinions are the result of an analysis of the statistics of the United States government and reading and observation.

Having traced from the statistics the lost American shipping into the hands of foreign competitors, I realize how it has been distributed among them, and which foreign country has received the lion's share.

In reference to the plea that in considering the question of restoring the American merchant marine, we must include the upbuilding of American ship yards, I submit that it should first be shown that those yards are owned wholly by American citizens.

I have discovered that the protected cotton thread industry is owned by English capital, and has been so owned for many years, such foreign ownership being cunningly concealed under American corporate titles; and as many other industries have also passed out of American into foreign ownership, it is reasonable to assume the probability that to some extent the American shipbuilding plants are similarly owned by foreigners.

A petition has been presented to President Taft by the writer, seeking relief from the established system whereby the American people as consumers are compelled to pay tariff taxes to foreign investors whose interests are located in the United States.

It seems to me that the membership of the most prominent business organizations in the country, organizations to which the President and Congress turn for information and advice as to legislation affecting the most vital needs of the people, should be critically examined; and the nationality of the interests represented by those members who are the agents of the foreign steamship companies which are enjoying the business that Americans have lost should be publicly announced in all proceedings where their activities are exerted and their names are mentioned, and this publicity should be most plainly shown in all communications presented by those business organizations to public officials.

There is every reason for believing that the representatives of the foreign shipping lines have taken, and will continue to take, every advantage that their membership in American business organizations offers to *defeat* all measures that might result in retaking the foreign carrying trade from them and restoring it to American ship owners. It would appear that they have secured such membership for that purpose.

If the American merchant marine is ever to be restored, the powerful influences of the foreign steamship companies, secretly exerted under the titles of Amrican business organizations, must first be broken by publicity.

For the advancement of the interests of American investors, it is essential that alien interests in the United States, amounting to about seven billions of dollars, shall be identified at all times by the nationality of their owners.

New York city. JOHN L. M. ALLEN, C.P.A.

The Free Ship Question

To the Editor of the SCIENTIFIC AMERICAN:

In your issue of April 1st is an article deploring the decadence of American shipping and proposing the revival of preferential duties.

This would be all right; but would it not be simpler for Congress to pass a law giving to American citizens the same right to buy and run vessels as is enjoyed by the citizens of Sweden, Denmark, Italy and other European countries? It is claimed that American citizens are free; why, then, should they be handicapped in this respect more than the citizens of any other civilized or even barbarous nation on the earth?

If this simple law were passed, it would solve this whole question, and would soon cover the seas with our flag, as they were in 1810. No subsidies, no preferential duties, no other coddling of any kind would be needed.

Our ships now are sailing the seas, but they are not allowed to fly the American flag. It is a humiliating fact that when an American merchant goes into the shipping business he must go to England or some other European country and ask for a flag to fly on his ships, if he wishes to avoid bankruptcy.

Under our present navigation laws, no American owner can operate vessels without higher freights. Higher freights mean lower prices for farm produce. So it is better for the American farmer to have his produce carried to market in an American ship flying the British flag, and receive good prices therefor, than to have it carried in the same ship, under the American flag, and receive poor prices therefor.

Riverton, N. J. FRUIT GROWER.

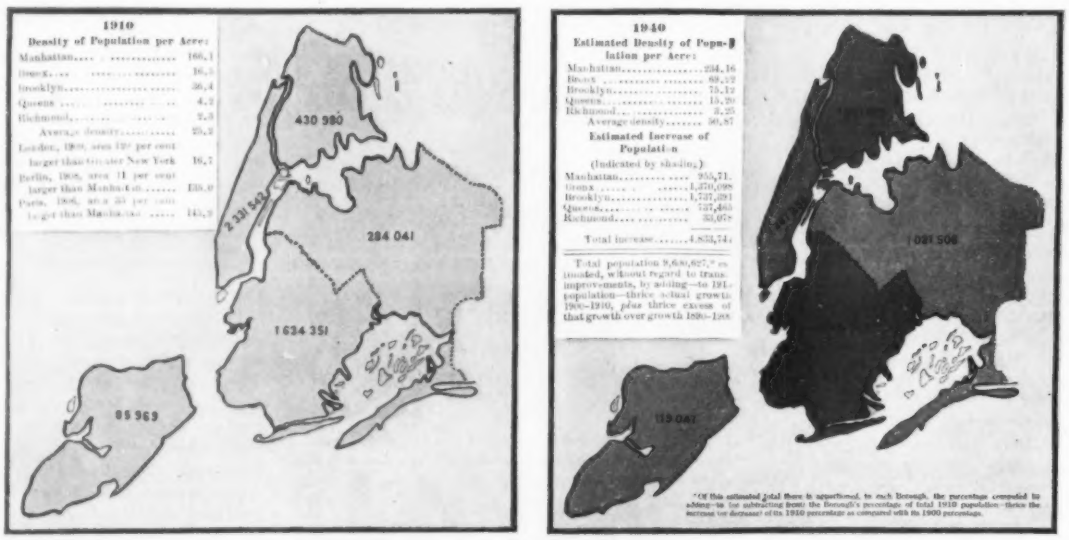
The Future Population of New York

To the Editor of the SCIENTIFIC AMERICAN:

Herewith please to find a map prepared at my instance to show the present and estimated future population of our five boroughs.

These estimates are believed to be conservative, even in view of the undoubted increase in the number of persons who will use existing and contemplated facilities for transporting passengers to and from their homes outside the city limits.

The purpose of the map is not to support or further any plan of rapid transit under consideration, but to cast light upon: 1. The desirability of establishing— *n o w* —plans for a comprehensive and consistent system of rapid transit. Among the essentials of such a system are: That it shall be adequate to meet future needs so far as they can be foreseen; that it shall tend toward more nearly *uniform per acre density* of population as between the boroughs; and that it shall render easy the separate construction of different parts of the entire system in order of urgency and of probable financial return. 2. The profit likely to accrue to those who shall furnish material *additions* to existing transit facilities *thus planned*. And 3. The sociological need for such additions.


1910
Density of Population per Acre:
Manhattan..... 166.1
Bronx..... 16.5
Brooklyn..... 36.4
Queens..... 4.2
Richmond..... 3.3
Average density..... 25.2
London, 1909, area 12% per cent larger than Greater New York 16.7
Berlin, 1905, area 11 per cent larger than Manhattan..... 135.0
Paris, 1906, area 35 per cent larger than Manhattan..... 145.3
430 980
2 331 542
284 041
1 634 351
85 969
1940
Estimated Density of Population per Acre:
Manhattan..... 254.16
Bronx..... 69,232
Brooklyn..... 75.17
Queens..... 15.70
Richmond..... 8.25
Average density..... 50.87
Estimated Increase of Population
(indicated by shading)
Manhattan..... 955,71.
Bronx..... 1,370,098
Brooklyn..... 1,737,291
Queens..... 737,465
Richmond..... 50,078
Total increase..... 4,853,74.
Total population 9,680,627,* as modified, without regard to transit improvements, by adding—to 1910 population—thrice actual growth 1900–1910, *plus* thrice excess of that growth over growth 1890–1900
021 508
119 047
*Of this estimated total there is apportioned, to each Borough, the percentage computed by adding—or subtracting from) the Borough's percentage of total 1910 population—thrice the increase (or decrease) of its 1910 percentage as compared with its 1900 percentage.

GREATER NEW YORK, 1910-1940

The figures printed on each borough show total population: Actual for 1910; apportioned estimate for 1940

Compiled by Walter Laidlaw, Ph.D., Executive Secretary, Federation of Churches, April, 1911.

L. E. OPDYCKE.

Rules Governing the Competition for the $15,000 Flying Machine Prize Offered by Mr. Edwin Gould

1. A prize of $15,000 has been offered by Mr. Edwin Gould for the most perfect and practicable heavier-than-air flying machine, designed and demonstrated in this country, and equipped with two or more complete power plants (separate motors and propellers), so connected that any power plant may be operated independently, or that they may be used together.

CONDITIONS OF ENTRY.

2. Competitors for the prize must file with the Contest Committee complete drawings and specifications of their machines, in which the arrangement of the engines and propellers is clearly shown, with the mechanism for throwing into or out of gear one or all of the engines and propellers. Such entry should be addressed to the Contest Committee of the GOULD-SCIENTIFIC AMERICAN Prize, 361 Broadway, New York city. Each contestant, in formally entering his machine, must specify its type (monoplane, biplane, helicopter, etc.), give its principal dimensions, the number and sizes of its motors and propellers, its horse-power, fuel-carrying capacity, and the nature of its steering and controlling devices.

3. Entries must be received at the office of the SCIENTIFIC AMERICAN on or before June 1st, 1911. Contests will take place July 4th, 1911, and following days. At least two machines must be entered in the contest or the prize will not be awarded.

CONTEST COMMITTEE.

4. The committee will consist of a representative of the SCIENTIFIC AMERICAN, a representative of the Aero Club of America, and the representative of some technical institute. This committee shall pass upon the practicability and efficiency of all the machines entered in competition, and they shall also act as judges in determining which machine has made the best flights and complied with the tests upon which the winning of the prize is conditional. The decision of this committee shall be final.

CONDITIONS OF THE TEST.

5. Before making a flight each contestant or his agent must prove to the satisfaction of the Contest Committee that he is able to drive each engine and propeller independently of the other or others, and that he is able to couple up all engines and propellers and drive them in unison. No machine will be allowed to compete unless it can fulfill these requirements to the satisfaction of the Contest Committee. The prize shall not be awarded unless the competitor can demonstrate that he is able to drive his machine in a continuous flight, over a designated course; and for a period of at least one hour he must run with one of his power plants disconnected; also he must drive his engines during said flight alternately and together. Recording tachometers attached to the motors can probably be used to prove such performance.

In the judging of the performances of the various machines, the question of stability, ease of control, and safety will also be taken into consideration by the judges. The machine best fulfilling these conditions shall be awarded the prize.

6. All heavier-than-air machines of any type whatever—aeroplanes, helicopters, ornithopters, etc.—shall be entitled to compete for the prize, but all machines carrying a balloon or gas-containing envelope for purposes of support are excluded from the competition.

7. The flights will be made under reasonable conditions of weather. The judges will, at their discretion, order the flights to begin at any time they may see fit, provided they consider the weather conditions sufficiently favorable.

8. No entry fee will be charged, but the contestant must pay for the transportation of his machine to and from the field of trial.

9. The place of holding the trial shall be determined by the Contest Committee, and the location of such place of trial shall be announced on or about June 1st, 1911.

The New York Public Library

How the Readers and the Books are Distributed in the New Building

FIFTEEN years ago, when the Astor and Lenox libraries of New York city and the Tilden Trust were consolidated into the New York Public Library, New York had nothing much to boast of in the way of a collection of books comparable in magnitude with that of the British Museum, the Bibliothèque Nationale of Paris, or the Imperial Library of St. Petersburg. At that time the consolidated library contained about 353,000 volumes. Now it includes, in its reference department alone, about 800,000 volumes, 300,000 pamphlets, 100,000 manuscripts, 70,000 prints, two picture galleries, and a large collection of maps. In the forty branch circulating libraries nearly 800,000 additional volumes are contained. When the consolidation of the Astor and Lenox libraries and the Tilden Trust was effected, the need of a single structure, which would not only house the Astor and Lenox collections, contained in buildings far distant from each other, but which would also have ample provision for increasing the number of volumes year by year, became more than ever apparent. In 1897, the first rough sketch of the proposed library was drawn by the director, Dr. John S. Billings. Now, fourteen years later, the building stands, a realized dream.

Situated on the site of the old Croton Reservoir in Bryant Park, one of the most accessible locations in the city, the white marble structure looms magnificently into view as one travels down or up Fifth avenue. Designed in the modern Renaissance style, the building is 390 feet long, 270 feet deep, and is built around two interior courts, each about 80 feet square. The cost of removing the old Croton Reservoir, and of constructing the new building, was about nine million dollars.

The books are arranged in seven tiers of stacks, occupying the greater part of the rear of the building. Contrary to the usual library practice, the main reading room is placed on the top floor at the rear, and immediately above the main stack room, with the result that better light and better ventilation are obtained. For those students and readers who use the library for more than brief and occasional reference, special reading rooms are supplied, so arranged that the books which they contain may be available for use in the main reading room, and yet permit unrestricted access to the special students. The administration quarters are sharply divided from the stacks and the reading rooms, the executive force being quartered in the south side of the library and the reading public and the volumes on the east, north and west sides.

The library, as it stands, has accommodations for about three million volumes, and over 1,700 readers. Its reading rooms are open to the public every day and every evening. The large reading room for the use of the general public has a seating capacity of 768 persons, and contains about 30,000 volumes of reference, accessible on open shelves. This reading room, as well as the periodical room, the newspaper room and the exhibition rooms, are open to every one. Special students in science, technology, sociology, public documents, Oriental history, literature, music and the like, may pursue their investigations in special rooms, each of which may be regarded as a special library in itself, planned so that it may be used without interference from the activities of the main reading room.

Although the new library is not devoid of mechanical apparatus for the quick handling and delivery of volumes, the necessity of supplying books for all classes of readers rendered it advisable to devise an architectural plan and an executive system which would distribute the reader rather than the volumes which he reads. Accordingly, we find the catalogue room serving as an ante-room to the main reading room. Any of the 6,000 catalogue trays may be taken out and consulted on one of thirteen tables. After having filled out his order blank, the reader hands it to one of the reference librarians at the information desk—an inclosure which stands in the center of the room, and to which all order blanks must be referred. The reference librarians assist the reader, if necessary, in consulting the card catalogue, and in showing him how the library is to be used. The reference librarian takes the order slip, gives it a number, gives the reader a check bearing the same number, and finally instructs the reader to go to the north or south side of the delivery desk in the main reading room. The order slip is shot through a pneumatic tube to the main reading room. The reader waits in front of an indicator. When his check number is flashed on the indicator his books are ready for him. The check is exchanged for the volumes that he has ordered. Instead of taking the books himself from the delivery desk, the reader may have them delivered to him, if he will indicate by number on his blank what seat he has taken.

In order to obtain the book ordered by the reader as quickly as possible, a very simple system of pneumatic tubes, lifts and conveyors has been installed. All told, there are eleven electric book lifts, of which only six need here be considered, since only they are directly concerned with the transferring of books from the stacks to the reading rooms. One of these book lifts travels from the stack floor No. 1 to the main reading room at the north end. At the south end of the stack room another lift travels from stack floor No. 1 to the main reading room. These end lifts serve the end rooms only, which are devoted to newspapers, patents, science, and technology. In the center of the stack room is a group of four elevators, traveling from the first stack floor to the main reading room. Each of these lifts can carry 250 pounds of books at the rate of 150 feet a minute, and each is so arranged electrically that the pressing of a push button at any landing will stop the car at that landing, or send it to any other landing, where it will stop automatically.

The four center lifts in the reading room, within the delivery desk inclosure, are so arranged that their control can be wholly centered at the reading room, with one operator in absolute control of all four lifts, and with all the other operating points on the various stack floors switched out. When one station is operating a lift another cannot interfere with it until after it has reached its destination, except that the center station on the reading room floor can change the destination, if desired. Automatic switches and latches are provided on the doors opening into the lifts, so that when any door in the shaft is open, the car cannot be moved. No door can be opened unless the car is at that particular landing.

On each of the seven stack floors is a bell to announce the arrival and stoppage of any of the four central cars at that floor. The bell does not ring when the cars pass the floor. By opening the door of the car, the bell is disconnected until the arrival of another car in the reading room. In the reading room lights are used instead of bells for each of the four doors, each light being operated by its own particular car and door. The lifts at the north and south ends of the reading room are similarly equipped.

The reader's slip is shot by means of a pneumatic tube system from the information desk in the catalogue room, as we have seen, to the inclosed delivery desk in the reading room. Here it is removed from its carrier, examined, and sent by another pneumatic tube to the proper stack. When the book is located, it is placed upon one of the four lifts in the center and sent up to the reading room.

In addition to the lifts for raising and lowering books from the various stack floors to the reading room, two horizontal conveyors have been installed on the sixth stack tier, running at right angles to each other. One of these horizontal conveyors runs along the north side of the building; the other from the north end of the building to the center of the stack room. The books can be transferred from the one horizontal conveyer to the other, and thence to one of the four electric lifts, which carry it to the reading room. Each of these horizontal conveyers consists of an endless track, with an endless rope running above it attached to two cars or baskets on wheels. The cars can change places and also stop at about half-way between the end stations. Both conveyers are driven from a main sheave at the document room end. The conveyers are operated by push buttons. The cars stop automatically at the end stations, and can be brought to a halt at any intermediate station by means of push buttons. The cars stop automatically where they are sent.

Limitations of space prevent any elaborate discussion of the various departments of the new library. Little more than a mere enumeration can be made.

In the basement will be found a newspaper room provided with sloping racks or stands for current newspapers, and large tables for consultation of bound volumes of newspapers. The library has one of the largest collections of files of old newspapers in the country. At present only about fifty important current newspapers are subscribed for, but the room, which measures 110 by 35 feet, will have space for 200.

The circulating library is a room 80 feet square in the basement, with shelving space for 20,000 volumes. The books in the stacks, however, are also available for circulation, for which reason the circulating room is in direct communication with the stacks.

Children's rooms and libraries are by no means new; but the new library has perhaps the best of the kind ever designed. The low book shelves that line the walls, the low tables and chairs, the cozy window seats, all of them suggest the library for children's use.

Still other departments that should be mentioned are the office, lecture room and class room of the Library School; a white marble exhibition room, 80 feet square, for the display of bibliographical treasures; reading rooms for current periodicals, having a total seating capacity of 100, in which rooms about 7,000 current periodicals, covering all subjects in all languages, are instantly available; technology rooms, in which 50,000 volumes are shelved for the use of engineers, patent attorneys, chemists and other investigators in the field of applied science; two rooms for the science collection, in which are shelved the 50,000 volumes in the library relating to the mathematical and natural sciences (astronomy, physics, chemistry); a library for the use of the blind; six study rooms for students and investigators who will spend some time in the library and who must refer more or less constantly to several hundred volumes at a time; special reading rooms for the consultation of the Slavonic, Jewish and similar collections; a reading room for economics and sociology, shelving about 20,000 volumes and seating twenty readers; a magnificent public document room, which contains about 80,000 volumes, and which is perhaps the finest collection of its kind in America; a room devoted to 20,000 volumes on local history and genealogy; two rooms for the collection on music; rooms for the exhibition of prints and paintings; a room for the Stuart collection of books, paintings, minerals, shells, bric-a-brac, formerly kept in the Lenox library; a room for 20,000 volumes on art of architecture; a room for the study of prints and photographs, with a working space for artists who wish to copy in paints; a map room, in which are kept some extremely valuable collections; three rooms for Americana, in which will be found the most complete collection of its kind in the world, with 20,000 volumes on American history alone.

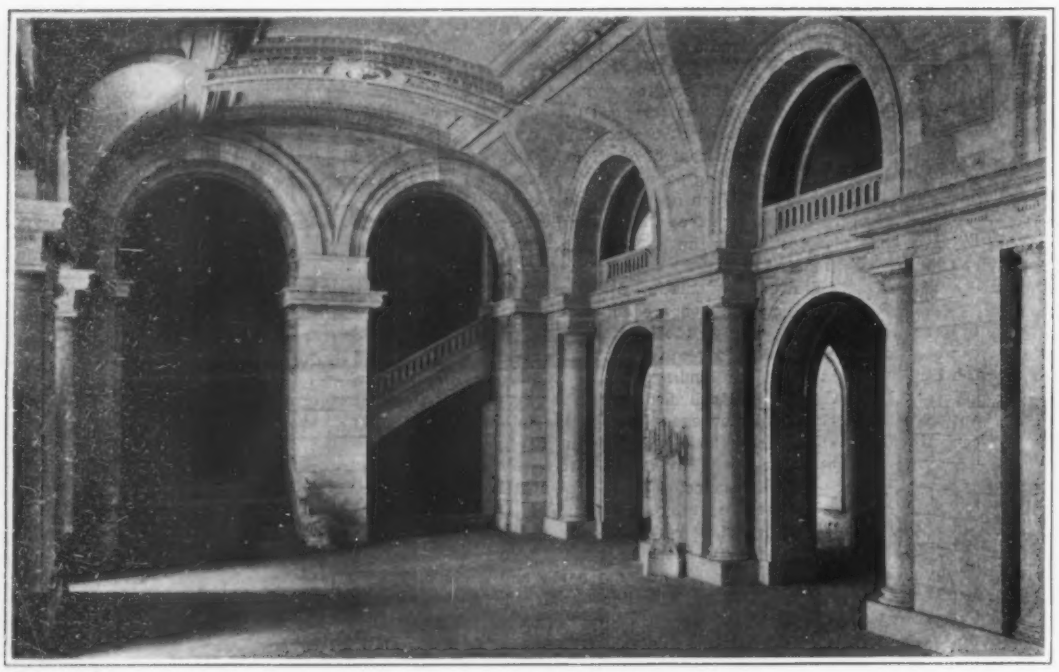
This cursory description of the plan of the library will show how admirably the needs of different readers have been kept in mind, how the man who desires a mere definition, a brief summary, or who desires simply to browse about, is given ample opportunity to satisfy his whims, either in the periodical room or the main reading room; how the scientific investigator, the engineer and the patent attorney, and the student of history or Oriental languages, are referred to separate rooms where they may pursue their studies quite apart from the general readers in the main reading room; and how a special student who must use the library for weeks at a time may have the use of a small room entirely to himself; and lastly, how the reader who desires to draw upon the circulating library is kept away, not only from the special students, but also from the main reading room itself. Following the suggestions of the director, the architects, Messrs. Carrère and Hastings, have provided a building which is not only a work of art in itself and a worthy monument to the largest city in the western hemisphere, but which automatically, we may say, divides the thousands of readers who wish to consult the books into the intellectual classes in which they belong.

Corrosion of Iron Machinery

WARNER and Davey, in England, have investigated the corrosion which is observed in iron machinery employed in certain industries, especially in the production of illuminating gas. No serious corrosion is caused by the cold ammoniacal liquors, but the tar may corrode the distilling tubes. The effect is due chiefly to the presence, in the tar, of the chloride, sulphide and cyanide of ammonium, which are dissociated by the elevation of temperature. The parts of the tubes that are corroded most rapidly are those which are subjected to irregular deformation in consequence of alternate expansion and contraction, due to changes in temperature.

One of the side entrances.

General view of the New York Public L



The entrance lobby finished in white marble.

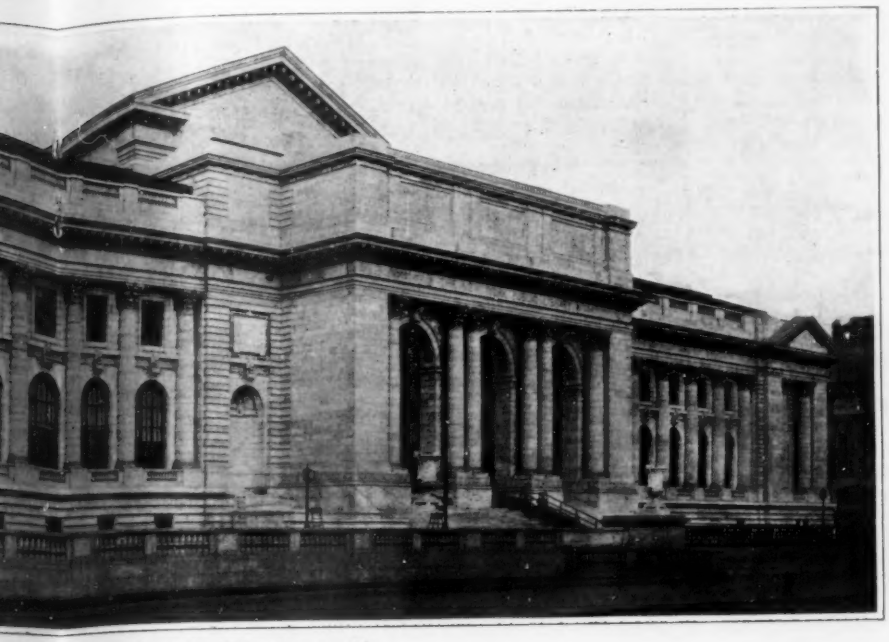
The delivery desk in the

One end of the main reading room, showing the delivery inclosure in the center.

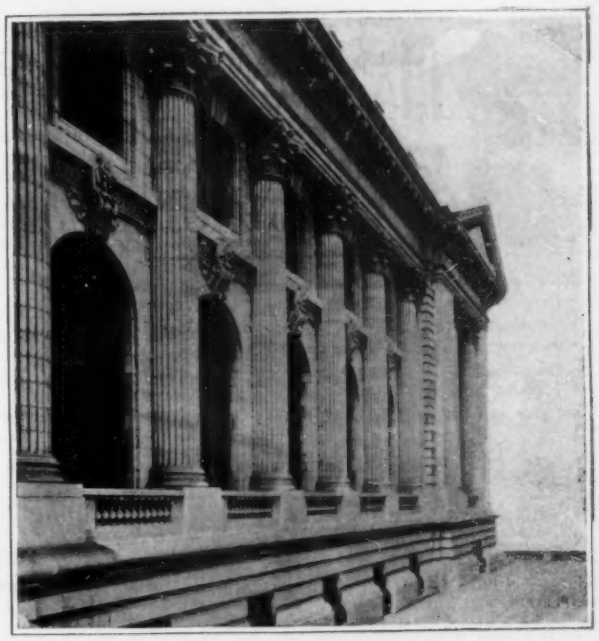
One of the flying staircases lea

Photographs by Floyd E. Baker.

THE NEW PUBLIC LIBRARY OF



ork Public Library from the Fifth Avenue side.

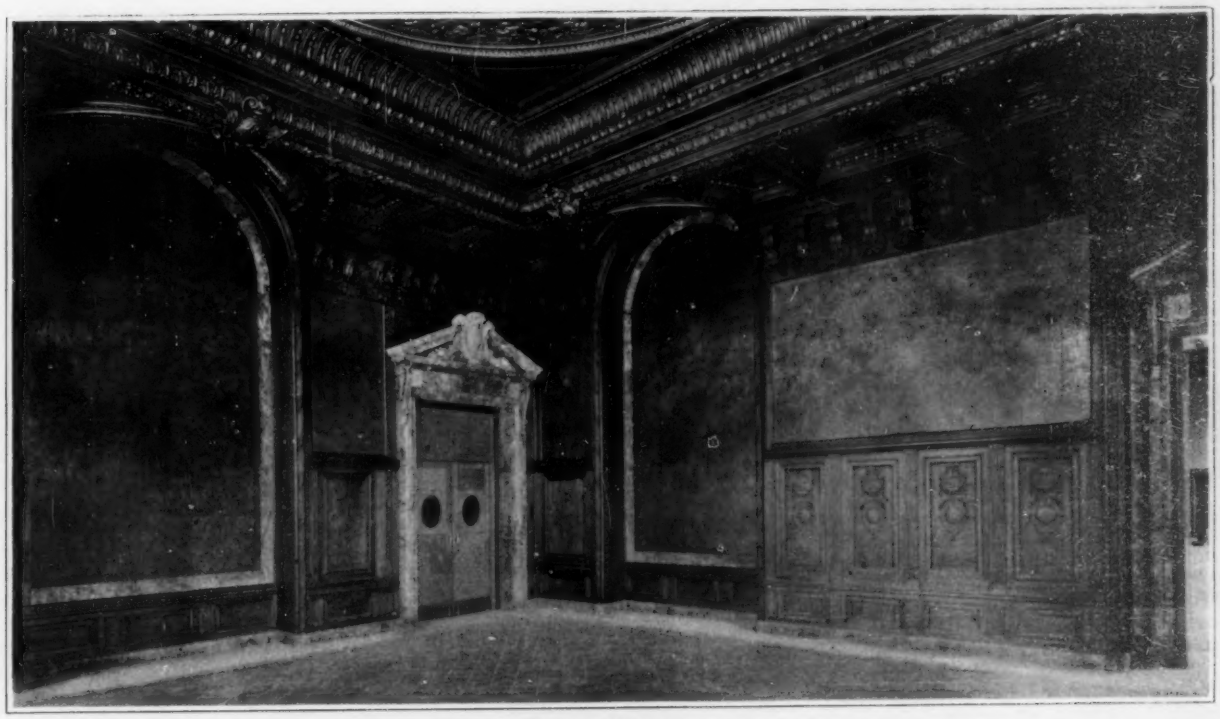


A portion of the façade.

y desk in the main reading room.

An exhibition room.

g staircases leading to the second floor.



The periodical room.

LIBRARY OF THE CITY OF NEW YORK

Carrère & Hastings, architects.

HANDY MAN'S WORKSHOP

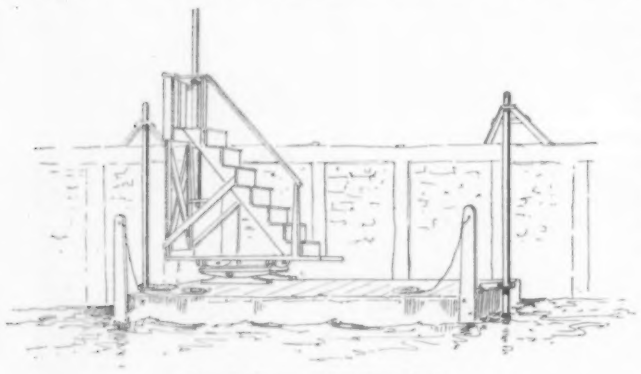
IN Handy Man's Workshop of May 6th we called upon our readers for simple methods of reboring an engine cylinder in a lathe. Much to our astonishment only one response has been received so far. We should have received a dozen or more from which several could be selected for publication. Of course the articles selected will be paid for.

The Handy Boatman

By Albert F. Bishop

THE following suggestions may prove serviceable to the handy man who owns a small boat:

A Landing Float.—It is not always convenient to place a landing float out in the stream twenty feet from the main dock so that it may be connected therewith by a long inclined "brow" or gangway. The accompanying sketch illustrates a float built by the writer which was placed alongside the dock, where it took up but little room and was readily accessible at any time, as the steps were always dry and clean. The float in rising and falling with the tide carried the steps with it. The upper part of the framework of the steps was arranged to slide up and down a pole which ran to a considerable height and was used as a flag pole. The steps were connected to the float by a form of universal joint. Two cheek pieces were nailed to the bottom plank of the steps to support a pair of trunnions made of gas pipe. These extended



Handy form of landing float.

lengthwise of the float, whereas another pair of trunnions mounted in cheek pieces attached to the float were set at right angles to the first trunnions. A frame situated between the steps and the float was hinged upon the two sets of trunnions, and in this way a universal joint was provided which permitted the steps to maintain their normal position regardless of the conditions of tide, or the roughness of the water. Had the steps been attached rigidly to a small float they would soon have been banged to pieces against the dock by the rocking of the float upon the waves. At each end of the float ropes were attached, through which vertical stakes were passed and driven into the mud. The upper ends were secured to the main dock.

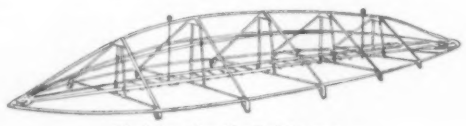
A Mooring Sail.—Launches or pleasure craft which do not carry sails always fret and labor at their moorings, when the bow line is attached to a stake or buoy.

Mooring sail for launches.

As the sea gets rough they are sure to lie in the trough, which brings the hull broadside to the wind. This brings the greatest possible pull on the mooring. A gale of wind will often part the bow line. The mooring sail keeps the boat head into the wind and will reduce the pull on the mooring fully one-half. The mooring sail is made V-shaped and attached to the after part of the boat cover, which may easily be set by using the flag staff and putting the end through a loop or grommet which is at the peak of the sail. The illustration shows the idea pretty well. There should be cords sewed to the after edge of the V-shaped sail. These cords are tied to the stern after the flag staff has been put in place.

Hoist Cover for Motor Boats.—The usual form of flexible cover for a motor boat is not absolutely weather tight. In the course of a year or two the rain leaks through quite easily. Some time since the

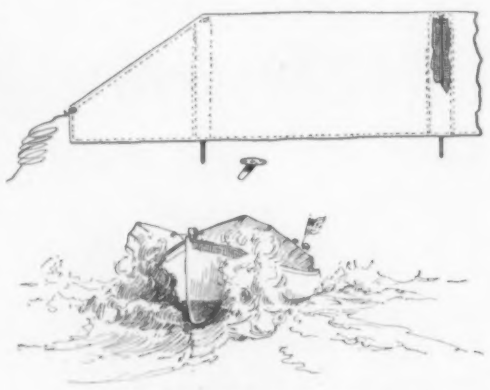
Hoist cover for motor boats.



Skeleton for the hoist cover.

writer decided to make a cover which would hold its shape as it was tacked over a frame and hence could be hoisted and fitted into place instead of being tied on. The hoist cover could be painted as often as desired. The cover was made nine years ago. It has been used continuously winter and summer ever since and is still in good condition. The hoist cover is very serviceable in the winter time when the launch is laid up. The illustration shows the framework for raising and lowering the device, which operation may be performed much more rapidly than that of tying on the ordinary cover. The launch is moored alongside the frame. To the framework are attached vertical parallel rods, and small cords fastened to the boat are caught around the rod, permitting the boat to lie exactly under the cover at all times. The skeleton of the cover, which is also illustrated, is made of straight strips of wood, sawed in lengths as desired. There should be feet along the bottom rib to rest on the plank sheer. The cover is tacked on the frame, sized with glue water and painted with a very little white lead, but with lots of oil and plenty of yellow ochre, which makes it a buff color. If much lead is used on these covers, they are apt to crack in a few years.

Spray Sails.—The spray sails are considered quite a convenience by those who have used them in open gasoline boats. They prevent nearly all the spray from coming aboard when the launch is headed into the wind. The sails are about 15 inches wide and two-thirds or three-quarters the length of a 25-foot boat. Galvanized iron rods 5/16 of an inch in diameter and 17 inches long are used. Holes are drilled in upper end of the rods, through which coarse twine is passed with which the upper edge of



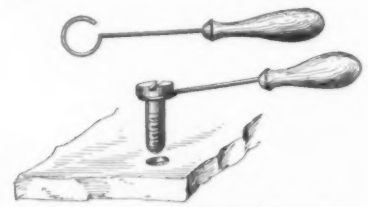
Spray sails for power launches.

canvas is sewed fast. It is better to place the rods in sheaths which are made by sewing strips of canvas crosswise of the spray sail about 3 feet apart. The sheath should be about 4 inches wide on the after rod, but can be made narrower as you go forward. Placing the rods in sheaths allows for a shrinkage of the canvas so that the rods can be easily set in the sockets, which are placed along the gunwale of the launch. The illustration shows one of the sockets with quite a bevel so as to give the necessary flare to the spray sail. Both ends are drawn taut by means of cords which are tied to the hull of the boat. The writer made the first pair of sails about eight years ago.

How to Insert Small Screws

By William Grötzinger

A SIMPLE tool to insert small screws, such as are used in clock work, is made as follows: Take a stiff piece of wire and bend the end into a loop. Put a small handle on the other end of the wire. This tool can be adjusted to different sizes of screws, simply by making the loop smaller or larger. To insert



Holder for inserting small screws.

the screw, hold it as shown in the illustration. The screw will then be supported steadily. After a few turns of the screw driver, remove the wire by pulling it. This simple tool will do away with the difficult task of holding the small screw with the fingers, and at the same time trying to manipulate the screw driver.

Shop Notes

Small Drills.—Mr. J. D. Adams, in his article of April 1st, 1911, suggests ordinary cambric needles for drills of small diameter. The ordinary needle drill I find has not enough clearance, and does not drill a true hole. Now if he will make his drill from a sewing machine needle, breaking the needle at the eye and grinding it as you would a twist drill, he will have a drill that will drill a true hole, and one that cuts twice as fast as the ordinary needle drill; also one that any chuck will hold steady and true.—ELBERT S. RAMSAY.

Suggestions on Hanging Doors.—I want to suggest a way of overcoming the difficulty found in hanging doors and shutters, viz., having one hinge jump off the pin while trying to insert the other. I think this job of trying to hang a door is worse than putting up stove-pipe. My idea is to have the pin or spindle (on which the door swings) about a quarter of an inch shorter on one hinge than on the other. Whether the top or the bottom one is the shortest, does not matter much. One could thus hang on the end with the long pin first, and it would not jump out while trying to insert the other. At times I have had so much difficulty in hanging heavy doors that I have sawed the pin on the lower hinge off a little. It works beautifully. I suggest that all users of builders' hardware should ask the makers to make the hinges that way, having a long and a short one constitute a pair.—JOSEPH MULLER.

A Paint Bucket Kink

WHEN a painter dips his brush into his paint bucket he always wipes it off on the edge, which after a time covers both outside and inside with paint.

Brush wiper for paint buckets.

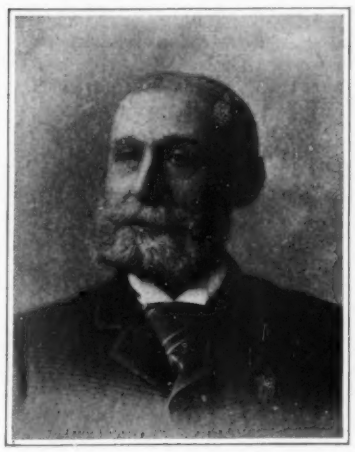
He also splashes some over the edge, and if doing inside work he must take extra care not to do this. To cure all this place a small piece of wood or wire across the bucket as shown in the accompanying illustration. Upon this the brush is wiped, and if any paint is splashed it will fall back into the bucket again. After the stick is full of dried paint it can be thrown away and another be substituted.

The Inventor's Department

Simple Patent Law; Patent Office News; Inventions New and Interesting

Principal Examiner Wilkinson

IT is not given to many men to hold one office for more than forty years or to remain in one employment for nearly fifty years, and the honor is that much greater when the office is so important and so honorable as that of principal examiner in the United States Patent Office. Dr. A. G. Wilkinson was appointed assistant examiner in the Patent Office in 1864, and became principal examiner in 1868. Prior to his appointment after graduating at Yale, he spent some time in studying medicine in Paris, going thence to Heidelberg. Later he was professor of languages at the University of Missouri.



Dr. A. G. Wilkinson.

During his term of service in the Patent Office, he has seen many commissioners come and go and has witnessed many changes in the practice and mode of doing business before the office. He had been examiner for some years before the great Commissioner Fisher's administration. He is by many years the dean of the corps of examiners.

He has had charge of surgical instruments, builders' hardware, including locks and latches, and has given much close personal attention to the subject of dentistry, being an expert in that particular art, both as to its present state and its history, modern dentistry having developed largely during the period when the class was in his charge.

In addition to his office duties, Dr. Wilkinson has been of much service abroad, having made five trips to Europe for the Patent Office. He was a member of the international jury of award at the Paris Expositions of 1878, 1889, and 1900, and was president of one section of the International Patent Congress of Paris in 1889.

It seems fitting that Dr. Wilkinson should be connected with patent matters, for his ancestors back to colonial times have been inventors. Wilkinson and Slater had the first cotton mill in this country at Pawtucket, R. I., and the old mill is still running. Jeptha Wilkinson, one of the family, was in interference with Hoe in the invention of the rotary printing press, and while Hoe won, Jeptha and his descendants have ever since been manufacturing and running rotary presses in England. Another of the family invented the sliding lathe, and the United States Congress gave him $10,000 reward when the invention was adopted in the government shops. In 1816 Job Wilkinson patented a boring and mortising machine; Jeptha Wilkinson was the inventor of a machine for making weaver's reeds; Israel Wilkinson invented machines for cutting screws, and Jeremiah Wilkinson invented machines for cutting and bending wire for carding machines, and the shears used by him in 1777 for making the first tacks and nails of cold iron are now in the possession of the Historical Society of Providence, R. I. All of the Wilkinsons above referred to are descendants of Capt. Lawrence Wilkinson, who was banished from England by Cromwell and came to what is now Providence, R. I., in 1647.

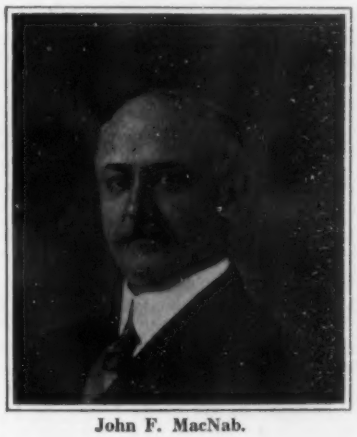
The Opening of the Conference at Washington of the International Union for Protection of Industrial Property

THE preliminary International session of the Conference was held on Monday the 15th; on Tuesday occurred the formal opening, when Secretary of State Knox and the newly appointed Secretary of the Interior, Walter Lowrie Fisher, made addresses of welcome. The address of Mr. Knox was translated into French for the benefit of the non-English speaking delegates, and distributed prior to his appearance on the platform. The language of the conference is in French, and ex-Ambassador Charlemagne Tower of Philadelphia, who was formerly accredited to the Court at Berlin, was elected permanent president. Mr. Tower, as president of the conference, and Mr. Edward Bruce Moore, Commissioner of Patents, as chairman of the delegation of the United States, will be the hosts at a formal dinner in honor of the foreign delegates, which will take place at the New Willard on the 27th instant. The President will also receive the delegates at the White House, but beyond these two functions no social events will take place until after the conference has finished its deliberations. Although an elaborate programme for the entertainment of the delegates had been planned, upon the assumption that the sessions would not be continuous from day to day, it was announced by M. Georges de Ro, of the Belgian delegation, and permanent vice-president of the Washington conference, that owing to the great importance of the matters before the conference, and on account of the extreme heat already encountered in Washington at this season of the year, the conference was anxious to make all possible speed toward the termination of the vast amount of work which has been laid out for them. The propositions of the various nations are to be taken up separately and considered in committee, and submitted to the conference for vote. Mr. Max Georgii of Washington, D. C., has been added to the Washington delegation as expert attaché and adviser, with Mr. Maurice M. Moore as secretary.

The delegate on behalf of Mexico, Señor Don José de las Fuentos, arrived on the day of the preliminary conference. Señor de las Fuentos was on board the ill-fated steamship "Merida," which was rammed off the Virginia Capes by the "Admiral Farragut," and is wearing his hand in a bandage as the result of injuries sustained while coming over the side of the sinking vessel hanging to a rope.

Principal Examiner Jno. F. MacNab

ALTHOUGH Mr. John Frederick MacNab has resided in Washington for more than twenty years, he still, with the persistency that should characterize a Scot of his plaid, retains his legal residence at Clinton, Worcester County, Massachusetts. While he passed his youth in New Hampshire and Massachusetts, he is a native by birth of New Jersey, having been born at Paterson in that State shortly after the close of the civil war. Completing his high school education at Clinton, Mass., he entered the Worcester Polytechnic Institute, graduating from its Mechanical Engineering Department in 1887 as Bachelor of Science. Being a practical, as well as a highly developed theoretical mechanical engineer, Mr. MacNab, with two of his classmates, was engaged to organize and institute a system of manual training in the District of Columbia, and the superiority of the manual training establishment in the district high schools to-day is due in no little part to the earnest, intelligent efforts of the organizers.



John F. MacNab.

Seeking what seemed a larger field of usefulness, Mr. MacNab, in 1891, resigned his position as director of iron

Delegates who are taking part in the International Conference for the Protection of Industrial Property, at Washington.

and steel work in the schools to accept a position as assistant examiner in the Patent Office, and was assigned to Division 14, which was his official home until his appointment as principal examiner in June, 1909.

He completed the regular and post-graduate courses in the National Law School, and is a member of the bar of the Supreme Court of the District of Columbia and of the Court of Appeals of said district.

While in Division 14 Mr. MacNab handled the classes in Sheet Metal Working, including Sheet Metal Ware Making, Metal Bending, Metal Working Tools, Packing and Storing Vessels, Metal Ornamenting, and Personal Wear Making. He is an expert, and one of the leading authorities in the art of can making, and fairly revels in the intricacies of the complicated machines which were added in large number to that art during recent years, when the class developed in the evolution from simple hand and foot operated devices to the perfected automatic machines of to-day.

Division 5, known as the fine arts division, now in his charge, includes music, bookbinding, jewelry and harvesters. It is left to the reader to trace any relation between music and harvesters or bookbinding and jewelry. The bringing together of the four classes named is consistent in at least one respect. It is clear there is no more connection between any given two than between any other two. The division, however, is an important one, the music, harvesting and bookbinding arts being particularly active at all times, and all containing inventions involving mechanisms of great intricacy of operation and complication of structure for accomplishing results of the most delicate nature in some instances, as in automatic musical instruments, and of producing a tremendous output in others, as in automatic bookbinding machines and in harvesters, self-binders, etc.

Mr. MacNab's long experience in the office, capacity for technical and difficult work, legal training and fine sense of patentability especially fit him for his position in charge of a difficult division.

Although Mr. MacNab has been a principal examiner but two years, he seems like a veteran, and fits in with the radically different classes from those he previously conducted, like the covering on a well-gloved hand. We sometimes speculate as to what a man would be if he occupied another position. If Mr. MacNab were not a Patent Office examiner, in which field he daily demonstrates his fitness and usefulness, we hazard the opinion that he would be a bank president, Secretary of the Treasury or something else in the line for which his financial ability admirably qualifies him.

Notes for Inventors

"Squeezing" Gasoline from Natural Gas.—In the oil and gas regions considerable interest is developing in the extracting, or as it is sometimes called "squeezing" of gasoline from natural gas, and some patented improvements are being exploited. The idea of liquefying gases is not, however, a new one, and a process quite similar to that followed in some modern gasoline plants was described in the seventies by Coleman, a Scotch scientist, whose "Mechanical Refrigeration," Vol. 2, will prove a valuable reference for anyone desiring to pursue this subject more in detail.

Patents in Orange Free State Province.—In one of the Washington papers there appeared recently a "special notice" signed by the Minister of Justice of the government of the Union of South Africa (Orange Free State Province), making it known that an application for a patent for a certain invention had been filed in the office of the attorney general of said government by a certain person residing at a place specified in Washington and calling upon those who might be interested in opposing the issue of said letters patent to appear at the office of the attorney general before the day of hearing specified, for the purpose of explaining their objections. This proceeding is doubtless in accordance with the laws of the Orange Free State Province.

A Gas Range Invention That is Needed.—In the domestic use of gas ranges by servants, much needless expense is incurred by the servant leaving the gas lighted in the range when not in use, and especially is this so in some forms of range in which the flame of the burner is not visible. Sometimes the servant will leave for the night and the gas will burn until morning. It seems that some one could provide an indicator or an alarm or some other means to indicate to the householder that the gas in the range is burning. Just how this can be best effected would require invention, possibly of a high order, but the field is a large one and should be attractive to inventors working along such lines. The mechanism might include automatic shutting off devices somewhat similar to those used for turning off lights in show windows; or cut-offs operated by clock work after the fashion of alarm clocks. Various other improvements will doubtless readily occur to an ingenious inventor.

The Need of a Fireproof Patent Office.—Every large fire teaches its lesson and a burning like that of the Albany Capitol wherein public records are destroyed brings home to those interested in similar records a warning that should not be disregarded. The recorded transfers of interests under patents in the United States Patent Office are probably the only record evidence of the titles to millions of dollars invested in patent rights. It is well to recall how these evidences of title are safeguarded against fire. These records include nearly 2,250 record volumes, each containing five hundred pages and each book is fourteen and one-half inches long, twelve inches wide and about two inches thick. It does not require calculation to demonstrate that considerable space is required for their storage. In addition to these records books, there are about four hundred and thirty-six Digests of Assignments in which all the recorded deeds are briefed and indexed. Now these books are of great value to all interested in the property interests secured by patent rights and no provision whatever is made for protecting them against fire. They are stored on wooden shelves in a hall which was "gutted" by the Patent Office fire of 1877 and in the event of a similar fire it is feared the books would be destroyed, as their great number would render their removal impracticable. This condition of affairs is doubtless deplored by the Commissioner of Patents and his subordinates more than by any one else, because they appreciate the importance of the records and their liability to destruction. It has been suggested that that section of the old model hall be made into a vault fireproofed according to modern methods and furnished with metallic shelving of capacity to hold not only the volumes now on hand, but those which will accumulate in the years to come. It is hoped that this or some similar fireproof storage space may be provided for these most valuable records.

Wanted: More Ozone to Breathe.—The president of a manufacturing company in the Middle West says he is not satisfied with the atmospheric conditions in which we are living, that we need more ozone for its directly beneficial results as well as for its purifying and disinfecting actions, and suggests the desirability of producing a commercial form of ozone generating apparatus that can be placed on the desk or bench of a worker and be coupled up and operated by the electrical current of an ordinary light or power supply. Of course, ozone may be formed by the passage of an electric spark through the air, but what is sought is an ozone apparatus which can be handled commercially in the manner specified.

A Punching Bag that is Almost Human.—A patent was recently issued to Nicholas W. White of Syracuse, N. Y., for a punching bag apparatus in which a punching bag is suspended from a ceiling track which is tortuous, so that when the bag is struck in addition to swinging and rebounding from the ceiling in the ordinary manner, it will travel relatively to the ceiling, and consequently the person exercising cannot judge in what direction the bag will rebound and move, and will be compelled to follow the bag in order to strike it, thus quickening the eye and exercising the legs and lower portion of the body as well as the arms and shoulders.

Legal Notes

Are "White Lead" and "Calcimine" Descriptive of the Same Properties?—The Court of Appeals of the District of Columbia in March held in deciding the case of The Muralo Company vs. National Lead Company that "white lead" and "calcimine" were not goods of the same descriptive properties. In the decision Chief Justice Shepherd says: "The fact that one intending to use oil paint for interior walls calls for white lead, but may be induced to use calcimine instead upon the representation that it is cheaper and when put upon the wall cannot be distinguished from oil paint by anyone but an expert, does not make a confusion in trade." The decision reversed that of the Commissioner of Patents sustaining an opposition filed on behalf of the National Lead Company.

President Taft as a Judge in Patent Causes.—In the white light of his present high position, we are in some danger of losing sight of the great ability exhibited by President Taft as a patent jurist, as evidenced by his decisions when sitting as a federal judge. Many of his decisions are notable, and had the bench been so fortunate as to have retained President Taft, there is little doubt he would have attained a celebrity as a patent judge equal to that of Justices Blatchford and Bradley. His facility and clearness of expression are shown in Thomson-Houston vs. Ohio, in which he says:

"From the earliest times, all who take part in a trespass, either by actual participation therein or by aiding and abetting it, have been held to be jointly and severally liable for the injury inflicted. There must be some concert of action between him who does the injury and him who is charged with aiding and abetting, before the latter can be held liable. When that is present, however, the joint liability of both the principal and the accomplice has been invariably enforced. If this healthful rule is not to apply to trespass upon patent property, then, indeed, the protection which is promised by the constitution and laws of the United States to inventors is a poor sham. Many of the most valuable patents are combinations of non-patentable elements, and the only effective mode of preventing infringement is by suits against those who, by furnishing the parts which distinguish the combination, make it possible for others to assemble and use the combination, and who, by advertisement of the sale of such parts and otherwise, intentionally solicit and promote such invasions of the patentee's rights."

Judge Taft's decision in Stearns vs. Russell is a leading one on the important subject of double use while that of Christy vs. Seybold is one frequently quoted to-day. When on the Circuit bench Mr. Taft's associates were Justices Day and Lurton, both of whom now grace the Supreme Court.

RECENTLY PATENTED INVENTIONS.

These columns are open to all patentees. The notices are inserted by special arrangement with the inventors. Terms on application to the Advertising Department of the SCIENTIFIC AMERICAN.

Of Interest to Farmers.

SAFETY TRANSMISSION DEVICE.—A. M. LEONI, New York, N. Y. This invention refers to transmission gears for use on mowing machines, and it is an improvement on the structures disclosed in two U. S. Patents formerly granted to Mr. Leoni. An object is to provide an efficient and durable mechanism which will permit the driving member to rotate relatively to the driven member when the engine is subjected to a sudden and unusual load.

Of General Interest.

NAME TAG FOR UMBRELLAS.—JUNJI MASKO, Box 495, Indianapolis, Ind. This improvement renders the identification of umbrellas easy and certain, will make it easy to trace one in case it is lost or mislaid, will prevent discussion of ownership, and will avoid unsightly marking of umbrellas by initials. The metals proposed to be used in making the ferrules are aluminum or thin sheets of copper, plated or japanned. It is not intended to be sold to the individual person directly. They are to be distributed among dealers in umbrellas with a pair of special pliers, and have them attach them upon making a sale. The inscriptions are to be written either by the salesman or the purchaser. It could be attached in sight, near the handle, or on inside where it is invisible when the umbrella is closed. The invention is shown herewith and is attachable in a few minutes.

UMBRELLA NAME TAG.

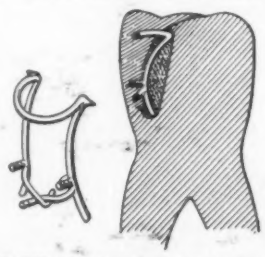
ICE SKID SWITCH.—C. H. MARTELL, Saginaw, Mich. This invention pertains to switches for ice skids or tracks, and refers more particularly to a switch of this class, comprising a floor over which the blocks of ice can pass, and a pivoted member associated with the floor, and mounted to swing across the same into different positions, and to deflect the ice laterally when it is in a predetermined position.

MINERAL BRIQUET.—G. K. HOLLISTER, JR., New York, N. Y. This briquet is formed of finely divided mineral materials, such as iron ore, found in abundance in sand, low grade iron ores, found in earth, decomposed rock, etc., with a binder, to permit of conveniently, economically and quickly forming the mass into briquets for almost immediate use, in a smelting furnace for smelting the mineral materials.

INTERLOCKING BRICK.—P. YENGST, New York, N. Y. The intention in this instance is to provide an interlocking brick, more especially designed for use as a fire brick in the lining of boiler furnaces and the like, and arranged to insure a secure and firm interlocking of successive courses as well as interlocking of the bricks in the same course, to hold the same from shifting in any direction.

WATER CARRIER.—J. C. TRULOVE, Shoals, N. C. The object of this improvement is to provide a device which is designed to run on a suspended wire or cable extending from a well, spring or other source of water, to the place where it is to be delivered, which may be manipulated by means of a single cord or cable for raising water, and also for transporting it.

DEVICE FOR RETAINING FILLINGS IN TEETH.—WILLIAM F. BABER, Post Office Box 208, Montgomery, W. Va. The invention illustrated is an improved retaining device for use in filled teeth and has for an object to provide a simple device to be placed in a large tooth cavity and to be cemented in place and having


DEVICE FOR RETAINING FILLINGS IN TEETH.

means which facilitate the anchoring of the retaining device in the cavity in such manner as to secure the retaining device in place so that the cement will operate to support a weak tooth, the securing device having projecting means for engagement with the overlying metallic filling.

BURIAL VAULT AND RECEPTACLE.—J. T. BOND, Palatka, Fla. The purpose of this invention is to provide an inexpensive and

substantial vault for receiving and protecting the casket, and which may be adjusted in length, to fit various lengths of caskets. The vault may be constructed of any desired material, and the sides and bottom, when formed of metal will have a portion of their length offset laterally to form the overlapping portions.

CRUTCH.—P. R. WILDE, 23 The Circus, Bath, England. This crutch is of the type consisting of two telescoping sections and a yielding arm rest. The object of the inventor is to construct such a crutch capable of being used in conjunction with a walking stick, umbrella, etc., and to this end it consists in providing means for enabling the lower part of the crutch to be detachably connected to the walking stick or the like which latter has its handle constructed suitably for carrying out this invention.

TANK GATE.—R. M. CLARK, Webb City, Mo. This invention is an improved discharge gate for jigs, settling tanks, or other receptacles for liquids containing water with sand, tailings, or other earthy or mineral matter in a finely divided state. Means provide for discharging a greater quantity of heavy material with a less quantity of water, which is an advantage of considerable importance.

OIL AND SAND SEPARATOR.—L. W. BROWN, Dec'd, Bakersfield, Cal. The present apparatus is for use in separation of the oil from the sand as fast as they are pumped from the well, which permits of the running of the oil to the storage without being delivered to the sumps or otherwise coming in contact with the ground or exposed where evaporation can take place, or the danger of fire.

CALCULATOR.—L. D. ROBERTS, Shawano, Wis. It is the principal object of this invention to provide a substitute for tables which will do away with the necessity of writing down the numbers and furnish the results in a convenient and orderly form so that the additions can be made directly, doing away with a large percentage of the work which is at present done in such cases.

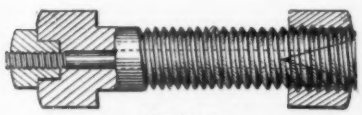
KILN.—C. HOOK, Vigo, Ohio. Heat is evenly distributed throughout this kiln and thus fuel is saved, emission of smoke is greatly lessened, and very wet ware may be burned with facility. The kiln may be water-smoked, burned, and cooled in a minimum of time without "whitewashing," "spilling," "scaling," overburning on top, or cracking, and the ware will be uniformly burned in every part. The arrangement prevents "drifting" when a strong wind is blowing against the fire boxes on the side of the kiln.

PHOTOGRAPHIC CAMERA. — R. GOLDSTEIN, New York, N. Y. In this invention the several parts can be readily assembled to reduce the cost of manufacturing to a minimum, and whereby the camera is rendered air tight, and can be conveniently manipulated for loading it in daylight, for sighting the object to be photographed, for making the exposure, and transferring the exposed plate from the camera to a bath, to develop the plate in daylight.

DISPLAY RACK.—F. N. SKINNER, Coffeyville, Kan. This rack is of the hanging type, and displays articles in stores and the like. For this purpose, use is made of a rod for suspension from a support, a clamp mounted to swing on the rod and adapted to support a table, and means for rigidly securing the clamp relative to the rod to hold the table substantially rigid relative to the rod.

Hardware.

NUT LOCK.—ARTHUR L. SARGEANT, Attica, Indiana. An object of the invention shown in the engraving is to provide a bolt in which the nut is locked thereto by a wedging action of the body of the bolt and by an offsetting of a portion of the thread of the bolt. In order to insure the positive locking of the nut



NUT LOCK.

on the screw threaded portion of the bolt, the wedge portion is provided with threads so that the nut can be readily screwed into the bolt. When the wedge portion is drawn inwardly into the wedge cavity, the threads thereon will be automatically offset from those on the body portion, so that they will positively bind the nut to form a sure lock.

WRENCH.—W. J. STOLZ, New York, N. Y. Among the principal objects which the present invention has in view are: To provide in a wrench means for extending laterally the working position of the head thereof; and to provide a construction which is simple, economical, efficient and durable. The invention is particularly designed to tighten the bolts or nuts located at the bottom of recesses or other structural depressions wherein a handle would not have space to move.

Heating and Lighting.

FUEL OIL REGULATOR.—E. M. JONES, Morenci, Ariz. Among the principal objects in view here are: To provide an apparatus for regulating the supply of oil in an oil furnace proportioned to the pressure produced by the heat within the furnace; to provide an apparatus to be operated by the pressure medium to produce which the oil fuel is furnished; and to provide means for manually fixing the relative ratio of the elements forming the fuel.

FUEL SUPPLY CONTROLLER.—C. W. LEITENBERGER, Johnstown, Pa. This invention relates to furnaces, heaters, boilers or other apparatus in which fuel is burned, and has for its object to regulate the supply of fuel automatically as the amount of fuel within the combustion chamber varies. The invention may be carried out in many different ways, according to the nature of the fuel employed and of the apparatus in which it is burned.

Household Utilities.

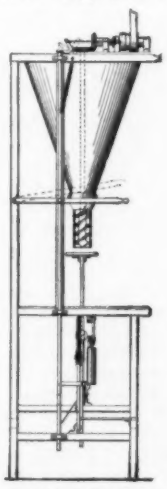
SUPPORT FOR COOKING VESSELS.—E. P. BREWER, Winnemucca, Nev. For the purpose of cooking use is made of a stationary ring provided with vents, a movable ring engaging the stationary ring to normally close the vents and adapted to move upwardly to open the vents, and a cover removably engaging the movable ring and adapted to hold a cooking vessel thereon.

VEGETABLE CUTTER.—H. E. RAMSEYER, Duluth, Minn. The intention in this instance is to provide a device wherein a plurality of cutting blades may be adjusted simultaneously to cause the said blades to cut at any desired depth, and wherein the blades when adjusted may be firmly held in position.

Machines and Mechanical Devices.

METAL BENDER.—V. J. MAYO, New Haven, Conn. The invention relates to a machine adapted to bend and plait a strip of metal and also to form one or more offsets in the strip. It is an improvement on the device shown in Mr. Mayo's co-pending application, and differs therefrom by providing means for forming one or more offsets in a strip of metal.

PACKAGE PACKER.—ALFRED K. ROBBINS, Cobleskill, N. Y. The invention illustrated herewith has reference to certain improvements in machines for use in filling packages with granular, pulverulent, crystalline, or other similar material, and one object is to provide for the automatic stopping of the delivering



PACKAGE PACKER.

mechanism when the package is filled to the required extent. The machine works with great accuracy and speed and cannot readily become clogged. The mechanism is comparatively simple, so that the machine may be manufactured and sold at a comparatively low price, and cannot readily get out of proper adjustment.

VENDING MACHINE.—L. HORINKO, New York, N. Y. This invention is an improvement in vending machines, particularly such machines as are constructed for dispensing articles of cylindrical form, such for example, as chewing gum, candy, cigarettes and cigars; and has for its purpose to insure the proper and certain feeding of the articles into and from the feed chute to the discharging carrier.

TESTING MACHINE FOR PLASTIC SUBSTANCES.—H. ABRAHAM, Boundbrook, N. J. The object in this case is to provide a new and improved testing machine, more especially designed for testing plastic materials, and arranged to give an accurate indication of the hardness of the material tested, and to provide a practically unlimited range of action of the machine.

CALCULATING MACHINE.—E. LEDER, Berlin, Germany. This improvement refers more particularly to machines having an operating member, numeral-bearing counter members, mechanism operable by the first member for actuating the counter-bearing members, locking means for preventing overpass movements of the counter-bearing members, and auxiliary locking means, both the locking means being controlled by the operating member.

POWER TRANSMISSION MECHANISM.—E. JAMES, Lincointon, N. C. This invention refers to devices for transmitting power. An object is to provide means by which motion may be transmitted from a shaft or other moving part to another shaft, with means for varying the speed or causing the reversal of the movement of the second shaft at will.

Railways and Their Accessories.

LOCOMOTIVE VALVE.—C. W. MANNOOCH, Fitzgerald, Ga. The improvement is in feed valves for cylinders and designed for use on locomotive cylinders. It provides a rocking valve in cylindrical form, which can be oscillated from any suitable moving part of the engine to properly deliver steam alternately to the opposite ends of the cylinder and to correspondingly exhaust the steam as the operation proceeds.

AUTOMATIC COUPLING FOR SIGNAL, AIR, AND STEAM BETWEEN CARS.—F. R. SHELDON, New Haven, Conn. This invention comprehends a pair of coupling heads provided with pipe sections extending loosely through it, each coupling head being further provided with spring mechanism for holding the respective pipes in predetermined normal positions, so as to allow them to yield relatively to the coupling head carrying them during the act of coupling.

CAR DOOR HANGER.—C. F. REIGH, Juniata, Pa. The inventor provides an outside slipping door adapted to be disposed flush with the outside of the car body; provides a construction for the operating mechanism of the door whereby the sag may be taken up; provides a means for locking the door; provides means for disposing the door in locked position to ventilate the car; and provides for mounting of the door whereby the interference of the same to the operation of loading and unloading the car is removed.

MINE CAR DERAILING DEVICE.—F. W. BYRNE, Everson, Pa. The object of the present invention is the provision of a simple mine car derailing device, adapted for use on inclines, for the purpose of derailing the last car of a string, to prevent damage in case of accident, such for instance as the breaking of the hitching device.

Pertaining to Recreation.

AMUSEMENT APPARATUS.—W. F. MANGELS, New York, N. Y. The object of this invention, which relates to carousels, is to provide an amusement apparatus, more especially designed for use in pleasure resorts, parks, etc., and arranged to accommodate a large number of persons at one time and to provide an exhilarating ride, part of the motion being produced by the occupants to suit their convenience.

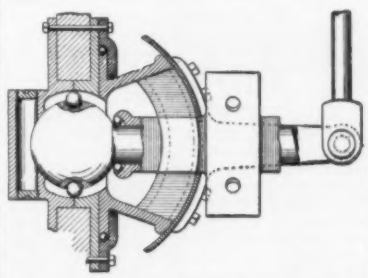
FISH HOOK.—HENRY D. BALCOM, Belfast, N. Y. Mr. Balcom's invention relates to fish hooks, and it has for its object to provide a fish hook having a divided shank, the members of which are roughened on their inner sides for gripping the dorsal fin of a minnow,

FISH HOOK.

a ring being mounted on the shank, and adapted to be moved along the same for pressing the members against the said dorsal fin, as shown in the illustration. As the minnow is not cut or bruised in any way, it may be used for a long period, avoiding the necessity of removing the bait from time to time.

Pertaining to Vehicles.

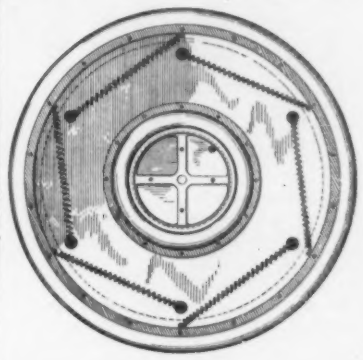
DRIVING AND STEERING DEVICE FOR VEHICLES.—EDWARD A. GOTTERBA, Box 1,154 Bisbee, Ariz. In the present patent the invention illustrated has for its object the provision of a new and improved driving and steering device for automobiles, marine vessels and other vehicles, and arranged to permit driving the vehicle or propeller wheel or turning the same into any angular position for use for steering purposes, the device being simple and durable in construction, easily manipulated, and arranged to effectively transmit the power and to reduce the friction to a minimum.



VEHICLE DRIVING AND STARTING DEVICE

DETACHABLE WHEEL RIM.—A. D. FOUCART, Muncy, Pa. This invention is an improvement particularly on those which are provided with pneumatic or solid rubber tires commonly used on automobiles, traction engines, and bicycles. By this improvement one is enabled to detach the rubber tire or outer portion together with the part to which it is attached, and to substitute a similar one in a few seconds.

WHEEL.—JOSEPH L. SPOONTS and EDWIN M. EUBANK, Ballinger, Texas. The invention shown in the accompanying illustration has

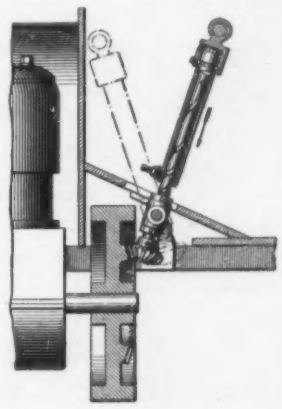


WHEEL.

for its object to provide a wheel having a pneumatic tire, but wherein the tire will be so placed that it will not contact with the ground, thus reducing the wear to a minimum, and preventing punctures and like injuries. Broadly the wheel consists of an inner and an outer wheel, the said wheels being movable radially and angularly with respect to each other, and yielding means for retaining them in normal position. The wheel might also be described as a wheel comprising a wheel, a ring concentric with the wheels and capable of the above movement.

ROLLER BEARING.—L. BADGER, St. Johns, Ore. This invention contemplates an antifriction bearing capable of free working under end thrust in either direction, or a lateral strain, as that occasioned by the weight of the load, the bearing consisting of an inner and outer bearing member and an internally threaded bearing support, the inner bearing member increasing in diameter in passing from the ends toward the center and the outer one composed of two sections threaded into the bearing support from the opposite sides thereof.

ENGINE STARTING DEVICE.—LLOYD B. HALLOCK and GEORGE T. KEEN, New York, N. Y. Address George T. Keen, Hotel Martinique, Broadway and 32nd Street, New York city. The object of the invention shown in the engraving is to provide a device more especially designed for use on internal combustion



ENGINE-STARTING DEVICE

engines employed in automobiles, motor boats and other power-driven vehicles, and arranged to enable the operator in charge to conveniently reach the device and to actuate the same for turning the engine shaft without much physical exertion or leaving the seat. For this purpose use is made of a grooved shaft and provided with a sleeve for turning the shaft in one direction to rotate the engine shaft.

VEHICLE WHEEL.—W. L. HOWARD, Trenton, N. J. This invention relates to vehicle wheels, and more particularly to a means employed for detachably securing the tire-carrying rim to the felly of the wheel. Mr. Howard's wheel operates upon the same general principle as the wheels disclosed in two prior patents formerly granted to him, but involves certain improvements in the cams and the means for mounting operating and controlling the same. Mr. Howard has invented another vehicle wheel of the type in which the tire is carried by a removable rim, so that in case of a puncture or other injury to the tire, the injured tire and the rim may be readily removed and replaced by a new rim carrying a previously inflated tire.

NOTE.—Copies of any of these patents will be furnished by the SCIENTIFIC AMERICAN for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

NEW BOOKS, ETC.

THE CONSTRUCTION OF A HOUSE. By Charles Gourlay, B.Sc. New York: John Lane Company, 1910. 4to.; 40 plates. Price, $2.75 net, postage 25 cents extra.

The drawings which make up most of the volume show in plan, elevation, and detail an English country house standing in its own grounds, with garage and chauffeur's lodge. To enable the student to understand the most approved methods of handling various building materials, the outer walls of the main building are of stone, those of the billiard room of stone with brick backing, the kitchen offices of rough-casted brickwork, the motor house of finished brickwork, and the chauffeur's lodge of brick with stone dressings for the lower story and half-timber work for the upper. The style is Renaissance somewhat modified by Scottish influence. Simple dignity characterizes the ornamentation, which is confined to moldings, carved enrichment being dispensed with. The detail drawings convey the most minute constructions in tower and stairway, in window and parapet, in roof and verandah, in mullion, lintel, and transom. Even the fireplace and the bookcase are the subject of careful sketches. All the plates are drawn to scale, with every dimension inserted, and with the materials shown by cross-hatching and stippling. The foreword suggests to the teacher or student the best way to use the plans with the object of inciting interest, impressing the memory, and training the taste and judgment.

CANE SUGAR. By Noël Deerr. Altrincham (Manchester) England: Norman Rodger, 1911. 8vo.; 592 pp.; illustrated. Price, $8 net.

A fine volume, carrying the reader through every phase of cane culture and sugar manufacture. The cultivated species is described botanically, root, stalk, leaf, and flower. The structure of the stalk is explained, and the explanation is borne out by illustrations. The function of the leaf as the "sugar manufactory" of the plant is clearly shown. The composition of the cane, which depends largely upon the variety and conditions of growth, is approximately given. The range and climate are indicated, and the different varieties of cane form the material of a long chapter. Full-page illustrations in color depict the Bourbon; the Rose, the Purple, and the Striped Bamboo; the White, the Black, and the Striped Tanna; and the delicate green Salangore. Suitable soils, and the manuring, irrigation, husbandry, and harvesting of the cane occupy succeeding chapters, and the pests and diseases to which it is subject are dealt with in detail. The mechanical part of sugar production follows—the extraction of the juice by mills, the diffusion process, clarification, filtration, evaporation to syrup, concentration of the syrup to massecuite, the separation of the crystals. Cuts and diagrams of the machinery used in the different processes are plentiful. Molasses is given a chapter to itself, and other chapters follow on the polariscope as applied to sugar analysis, the optical assay of sugars, and the control of the factory. Important tables form an appendix to a noteworthy volume.

THE AMERICAN ANNUAL OF PHOTOGRAPHY. 1911. New York: George Murphy, Inc. 8vo.; 328 pp. Price, paper, 75 cents; cloth, $1.25.

The twenty-fifth volume of the American Annual of Photography has kept pace with the progress of the art, and its articles and the two hundred illustrations make up an issue of high merit. There are thirty-two plates in color. With one or two exceptions the portrait studies are very good, and the outdoor scenes are generally satisfactory. The articles are based upon such a wide variety of subjects that only a very few can be mentioned here. "Photography at Night," "Marine Photography," "The Sky in the Landscape, "Greenhouse Photography," and "Flower Portraits" treat of special subjects and their handling. "Stereoscopic Photography Simplified," "Duplicating Lantern Slides," and "Modified Tank Development" deal with methods and processes. Among other papers worth noting are "The Tele-Photo Lens and the Hand-Camera," "Photographic Book Plates," and "Document Photography."

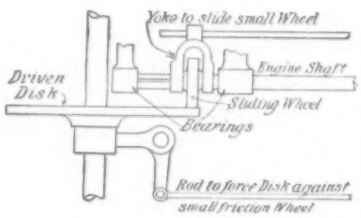
NOTES ON IRRIGATION WORKS. By N. F. Mackenzie. New York: D. Van Nostrand Company, 1910. 8vo.; 111 pp. Price, $2.50.

The writer was lately Under-Secretary for Irrigation to the Government of India, and these notes are a series of lectures delivered at Oxford in 1909. As comparatively few of the problems in engineering and economics may be presented within the time of a half-dozen lectures, the discussion is confined to, first, a general idea of irrigation works and their results, with the statistics required for an irrigation project; types of weirs are then considered, with the principles on which their design is based; the development of Egyptian irrigation, the design of irrigation channels, and irrigation and land revenue in India, form the subjects of the last three lectures and conclude the volume.

Notes and Queries.

Kindly keep your queries on separate sheets of paper when corresponding about such matters as patents, subscriptions, books, etc. This will greatly facilitate answering your questions, as in many cases they have to be referred to experts. The full name and address should be given on every sheet. No attention will be paid to unsigned queries. Full hints to correspondents are printed from time to time and will be mailed on request.

(12458) I. N. S. asks: Please explain the principle of friction drive and transmission as applied to automobiles in comparison to the shaft drive and gears. A. To permit of varying the number of revolutions made by the engine per revolution of the road wheels of the automobile, several sets of gearing of different ratios are introduced between engine and axle. By suitable levers, any desired pair of gears may be slid endwise into mesh, while the other sets are at the same time slid out of mesh, so that the ratio of the meshing pair determines the relative speed of



wheel and engine. The friction-drive car accomplishes the same result by running together two smooth wheels, which having no teeth, must be pressed hard together to cause one to drive the other. By making the engine shaft operate a small wheel whose edge runs on the face of a large disk on the axle, or geared to the axle, the speed of the car is increased as the small wheel is slid along its shaft toward the center of the disk, and decreased as it is slid out toward the edge of the disk. The advantages of the friction drive are that it is noiseless, can be run at any speed between its fastest and slowest limits, having no "steps" like the toothed-gear differential, and that the friction clutch is combined with the differential by merely connecting the foot treadle to the thrust bearing behind the disk, and pushing the latter into contact to start the car. Its disadvantages are lack of power in case the fans become greasy or the thrust bearing wears, and rapid wear under some conditions of use. While there are very few makes of friction-geared cars on sale, these few appear to have done very well.

(12459) A. J. G. says: I wish you to explain an optical illusion that we see here every day. I live in a yard inclosed with a sawed picket (paling) fence, the house about one hundred feet from the fence, which is on the sidewalk. Whenever an automobile passes, the wheels as viewed through the fence seem to be moving backward, and that part of them next the ground seem to be moving slower than the top portion. A. The optical illusion which you describe is called a stroboscopic effect, because the parts of the moving wheel seen through the palings by intermitted lights are twisted, due to the motion of the wheel while it is partly eclipsed by the palings. The axis of the wheel is moving along while the top moves forward and the bottom moves backward with reference to the axis. Whether the wheel shall seem to turn backward or forward is determined by the relative velocity of the wheel to the width of the palings and openings between them, that is, the number of eclipses and the number of spokes which pass the openings in the fence. The same effects can be seen in the projection of moving vehicles in the moving picture machines.

(12460) J. S. C. writes: In reference to query No. 12437 in SCIENTIFIC AMERICAN, April 22nd, 1911, if you will gaze fixedly upon Venus or a bright star on a dark night when the sky line is inconspicuous until the eye muscles become somewhat fatigued, the star will appear to float slowly from its place to the extent of some ten or fifteen degrees. It is of course because the tired eye muscles relax and permit the eyeballs to revolve in the sockets. This causes the image to drift across the retina, and the motion is ascribed to the star. Some have even thought the phenomenon a "jack o' lantern" until they were asked to try the same thing on any other bright star or distant lamp in a neighbor's window. I am inclined to think this is what is referred to by Mr. J. B. F., instead of a scintillation or twinkling on the part of Venus. His use of the term "floating" suggests it. A. We think you are right in your opinion that the drifting of Venus spoken of by correspondents is due to gazing steadily at the star. This we did not think of because it is not peculiar to stars. The effect may be produced by looking steadily at anything whatever, near at hand or remote, for a considerable time.

Restoration of Documents Charred by Fire

(Continued from page 521.)

tively small, and can be recovered after the record has been transcribed, by burning the carbon and collecting the ash.

The opening of folded documents required the cutting at each fold, and the various sections were floated and assembled carefully, to be treated as intact documents.

A small proportion of partially charred matter came up for restoration. These presented some most startling phenomena. Part of the writing would appear as clear as fresh writing on paper of like color, and some of the writing on the same page would be invisible. This appeared when the paper had only been scorched to a color no darker than ordinary wrapping paper.

Peroxide of hydrogen succeeded with all that we treated, but presumably methods known to succeed for faded papers would be as good or better.

Under this class of records I had presented some impression sheets from manifold books, the impression having been made with aniline transfer paper. They were carbonized to a seal brown. I finally obtained these records by floating face down on a bath made alkaline with sodium bicarbonate and reading the reversed writing that appeared through the paper by means of looking glasses. No results could be obtained by treatment on the face side.

The following should be known by users of safes:

Documents should not be folded. Papers or currency should never be kept with coin, jewelry, etc. Many papers and large amounts of currency were broken to pieces in removing safes from ruins. Never place important papers or currency in wallets, or use rubber bands. These are melted and cement the contents, making it difficult to separate. Don't decide that currency or documents are destroyed by being broken. Large sums were lost through this mistaken notion. It was surprising what success was obtained in piecing together small fragments of currency, etc. Many thousands of dollars were redeemed by the government, at small cost, where the various parts had been preserved, and many thousands lost needlessly.

The Variable Speed Aeroplane

(Continued from page 523.)

arched sustaining surfaces x are capable of rotation on transverse horizontal axes Y. M is the motor, R the fuel tank and C the chauffeur's seat, and L a lever by which the chauffeur can control the inclination of the propeller blades if their automatic regulation becomes deranged. S is the seat of the pilot, who operates the rudders and also varies the inclination of the sustaining surfaces by turning the wheel T. The mean inclination of these surfaces to the horizon, as they are drawn in the figure, is about 15 degrees, but their inclination can be diminished to 5 degrees (indicated by the dotted line w) for soaring at very high speed, and increased to 30 degrees (indicated by y) for landing.

In starting from rest on the ground (or water) the surfaces are set as nearly level as possible. When sufficient velocity has been attained the inclination is suddenly increased to 15 degrees, and the aeroplane rises in the air, without using the full power of its motor, according to the usual practice. The inclination of the sustaining surfaces is then gradually diminished and the power increased by controlling the feed, until the maximum power is developed. At this moment the inclination of the sustaining surfaces is about 7 degrees, and the aeroplane has attained its normal speed. In landing the inclination of the surfaces is gradually increased to 15 degrees, while the power is diminished, and just before the ground is struck the ignition is cut off and the inclination of the sustaining surfaces is suddenly increased to its maximum value of about 30 degrees.

The Current Supplement

AMONG the more interesting articles that appear in the current SUPPLEMENT, No. 1847, we may mention an excellent speculation by J. Löwy on the nature of invention.—The development of

LEGAL NOTICES

PATENTS

INVENTORS are invited to communicate with **Munn & Co., 361 Broadway, New York,** or **625 F Street, Washington, D. C.,** in regard to securing valid patent protection for their **inventions. Trade-Marks** and **Copyrights** registered. **Design Patents** and **Foreign Patents** secured.

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Earn $10 to $15 a week and hold your position besides. No Canvassing. We as manufacturers of patented just in season specialties have new easy mail order plans to keep our factories busy. We furnish everything. Large profits. Small capital. Experience unnecessary. If you are one of the want-to-go-ahead kind, write for our most modern plans. Sworn statement. J. M. Pease Mfg. Company, 1-2 Pease Bldg., Michigan St., Buffalo, N. Y.

Concern doing large business in bronze marine goods desires to acquire patents or rights to suitable article to sell during the fall and winter. Well equipped brass foundry, machine shop and polishing room. Near New York. Article of non-ferrous metal preferred. Address C. B. F., Box 773, New York.

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PATENTS FOR SALE.—Royalty, or capital to manufacture, Hydrocarbon Engine, Magneto Electric Machine, Muffler for Gas Engines, Safety Appliance for Elevators. Address P. O. Box No. 119, Sandusky, O.

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MISCELLANEOUS.

FREE—"INVESTING FOR PROFIT" Magazine. Send me your name and I will mail you this magazine absolutely free. Before you invest a dollar anywhere—get this magazine—it is worth $10 a copy to any man who intends to invest $5 or more per month. Tells you how $1,000 can grow to $22,000; how to judge different classes of investments the real earning power of your money. This magazine six months free if you write to-day. H. L. Barber, Publishers, 423-28 Jackson Blvd., Chicago.

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INQUIRY COLUMN

READ THIS COLUMN CAREFULLY.—You will find inquiries for certain classes of articles numbered in consecutive order. If you manufacture these goods write us at once and we will send you the name and address of the party desiring the information. There is no charge for this service. **In every case it is necessary to give the number of the inquiry.** Where manufacturers do not respond promptly the inquiry may be repeated.

MUNN & CO., Inc.

Inquiry No. 9234.—Wanted a small specialty of merit for office, household or personal use and of universal salability, to sell for from $3 to $25. Proper articles can be financed.

Inquiry No. 9235.—Wanted, names and addresses of manufacturers of machinery and appliances for making celluloid.

Inquiry No. 9236.—Wanted, the name and address of the firm making the New England Filling Machine.

Inquiry No. 9237.—Wanted, information relative to the Parmelee Automatic Aerated Water Still and Sterilizer.

Inquiry No. 9238.—Wanted, addresses of those who own deposits of rottenstone, lump pumice, infusorial earth or rubbing stone.

Inquiry No. 9239.—Wanted, addresses of parties who can ship ores containing any of the following elements Vanadium, molybdenum, uranium, tungsten, titanium.

Inquiry No. 9240.—Wanted, addresses of owners of limestone beds running not less than 98 per cent, and near a railway.

Inquiry No. 9241.—Wanted, addresses of owners of deposits of molders' sand suitable for heavy castings.

Inquiry No. 9242.—Wanted, addresses of makers of bag valves.

Inquiry No. 9243.—Wanted, address of maker of Rover's monogram embossers.

Inquiry No. 9244.—Wanted, address of manufacturers making rollers, scrapers, and driers suitable for making soap leaves.

Inquiry No. 9246.—Wanted, addresses of parties having raw materials or minerals containing potash in any form.

Inquiry No. 9247.—Wanted, to buy a Parmelee aerated water.

Inquiry No. 9254.—Wanted, the name and address of manufacturers of lead pencils and pen holders, such as are used for printing advertisements on.

Inquiry No. 9255.—Wanted, to buy a patent roller, a ball-bearing axle, which could be purchased on a royalty basis; it must be cheap and fully proved.

This Man Knows How to take care of his tires

9,000 miles with no trouble but a puncture

"I purchased two 35 x 4 1-2 Hartford Clincher Round Tread casings and tubes on September 18, 1909, and placed them on the rear wheels of my roadster, which weighs 2850 pounds. I have had this car in constant use, with these casings, since Sept. 21 and have run them over 9,000 miles with one nail puncture."
W. H. C. LOVETT, Austin, Tex.

THERE is nothing extraordinary about getting such mileage from United States Tires, if you know how to *take care* of them.

The business of the

Service Bureau
of the United States Tire Company

is to show motorists how to get *from* these good tires

Continental **Hartford**
G & J **Morgan & Wright**

the long mileage built *into* them by their makers. You can have all the helpful suggestions of the Service Bureau without cost, except for the stamp to

SEND IN THIS COUPON

Service Bureau
United States Tire Company
1797 Broadway, New York
Please send me all literature issued by your Service Bureau.

*Name*_____

*Address*_____

*Make of Car*_____ *Tires*_____

PARIS GARTERS
No Metal can Touch You

For Summer Comfort

Look for the name PARIS on every Garter

25-50¢ A STEIN & CO. MAKERS CHICAGO U.S.A.

A BIG SUCCESS
New Discovery Revolutionizes Old Methods

The Wonderful Canchester. Greatest light known. Many times brighter than electricity, gas, acetylene, etc., at **1-10 the cost.** No trimming wicks—safe, clean, odorless; BURNS WITH OR WITHOUT MANTLE. Burner fits all lamps. Guaranteed. **Pronounced by State of Pennsylvania "Most efficient light found; compares with daylight; not injurious to eyes or health."**

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We want a few more live hustlers in open territory. Experience unnecessary. Everybody wants CANCHESTER LIGHTS. Showing means selling. Price within reach of all. OUR AGENTS ARE COINING MONEY. **Big profits** and immediate returns assured. This is a lifetime opportunity. Act quick for exclusive territory. Write today.

CANCHESTER LIGHT CO., Dept. S. A., 204 N. State St., Chicago

Icy-Hot

The Bottle That Keeps Hot Liquids Hot 24 Hours Cold Liquids Cold 3 Days

You can have hot or cold drinks while traveling, boating, hunting, motoring, fishing, etc., or keep warm milk for baby, cold water for children or invalids, by bedside, all night, without bother.

Icy-Hot Jars—one and two quarts—keep stews, vegetables, etc., hot without fire—desserts cold, without ice.

Accept No Substitute
There's No Bottle Just As Good

The inner glass bottle is easily removed, sterilized or cheaply replaced if broken. Perfectly sanitary—liquid touches only glass. Handsome nickel or leather covered case.

Many New Exclusive Features

At dealers—look for name *Icy-Hot* on bottle. Pints, $1 up; quarts, $2.50 up. Write for booklet.

ICY-HOT BOTTLE CO., Dept. F Cincinnati, Ohio

radioactive investigations in recent years, and especially the increasing employment of radium and its emanation in medicine, has created a strong demand for radioactive substances, which cannot be satisfied by radium itself. As a substitute for radium, the slowly disintegrating derivatives of thorium, which are known as mesothorium and radiothorium, suggest themselves. In order to understand the possibility of that substitution, an excellent review of the whole subject is presented.—Some aeroplane under-carriages are described and illustrated.—Within the last few years some of our railroad, industrial, and steamship companies have begun to realize the important part that mechanical transference plays in the quick and economical handling of material. Mr. Richard Devens treats this subject admirably in a paper entitled "The Mechanical Handling of Materials."—A novel type of gas machine is described and illustrated.—A. F. Bock tells how houses are moved in Germany.—A new engine has been introduced to take the place of the older steam-driven blowing engine. This is the Slick blowing tub, which is described.—A series of experiments in connection with the heating and ventilation of the home are published.—Mr. A. H. Godard writes on the bee as an architect.—Mr. Saeuberlich continues his excellent paper on Diesel marine engines.—The discourse delivered by Prof. William H. Bragg, of the Royal Institution, on "Radioactivity as a Kinetic Theory of a Fourth State of Matter," is published.

Accidents to Dirigibles and Their Lessons

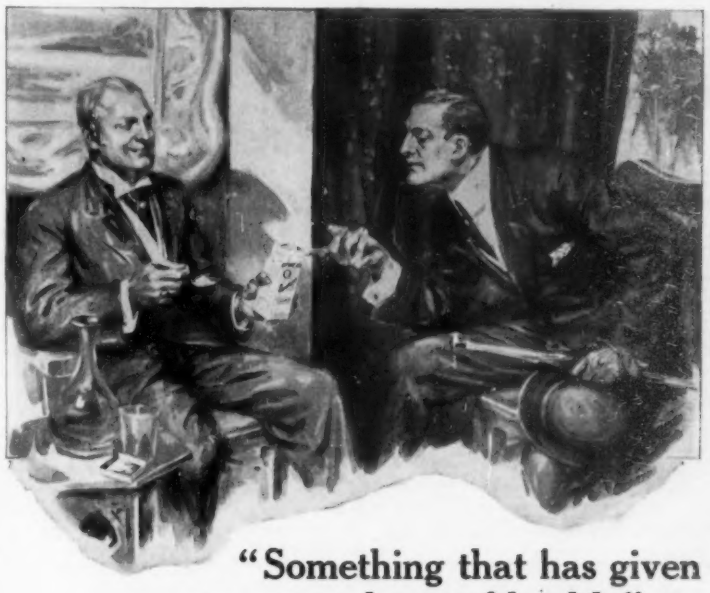
By Carl Dienstbach

WITHIN a few days of one another, the new "Deutschland" (Count von Zeppelin's latest aerial leviathan), a Parseval airship, and the English army dirigible have all come to grief. Two years ago, these disasters would probably have materially checked the development of a type of craft whose possibilities are little understood in this country. As it is, a few timid stockholders in the companies which have done so much to exploit the dirigible in Germany may lose heart; but on the whole, the performances of the giant dirigible have shown that the type has a commercial future, and that it has come to stay. How promising is the development of commercial navigation of the air could hardly have been more strongly emphasized than by the Parseval company's decision to increase its capital considerably, and to begin the construction of a newer and bigger passenger ship, and a newer and larger shed in which to house it—all for the Berlin service.

The wrecking of one of Count von Zeppelin's giant dirigibles one after the other has no doubt called forth comments of approval; for only too often has the big dirigible been condemned because the problem of handling it properly on the ground has not yet been satisfactorily solved. Critics of the dirigible are apt to forget that before Blériot succeeded in producing his model No. 10, with which successful flights were first accomplished in a monoplane, machine after machine had come to grief. What is more, they also forget that in these days of the perfected Blériot, when monoplanes by the score flit through the air, more flying machines are wrecked than at any other time in the history of aerial navigation. Does that mean that Louis Blériot and other builders of flying machines will cease to manufacture?

Even though it be urged that the monetary loss involved in the wrecking of a Zeppelin is stupendous, it will probably be no difficult matter to prove that the financial loss involved in the wrecking of hundreds of monoplanes and biplanes is not much less than that involved in the loss of all the Zeppelins up to date. Surely, the dirigible has earned an undeserved reputation because its wrecks are spectacular, and because the loss is concentrated.

The latest Zeppelin wreck is instructive. It emphasizes the fact that although the dirigible has been so far perfected that it is able to navigate the air speedily and safely, there is still no adequate method of handling and docking it. The first injury that befell the



"Something that has given me a new lease of health."

"George, I've seen you use that little box of white powder every day here at the club for some time, and now my curiosity has got the better of me. Just what is it?"
"Why, that is something that in six weeks has given me a new lease of health, has wonderfully improved my digestion, has given me strength and buoyancy, and, I am firmly convinced, has saved me from a serious breakdown. It's the food-tonic called Sanatogen."

A NEW lease of health! The eager desire of countless sufferers from nervous exhaustion! Can Sanatogen really bring relief? Can it really convey to the system that which the starved nerves crave? Can it really so revitalize the body that digestion and assimilation become normal once more? Has it really the power to reconstruct cell and tissue?

Fifteen thousand letters from practicing physicians answer these questions in the affirmative. Over 120 original articles in leading medical journals prove every claim to be true. *Every day*, in every land, over 100,000 people take Sanatogen, feel its invigorating and rejuvenating effect, bear witness to its remarkable upbuilding and revitalizing power.

If you need a tonic, do not get "some tonic," get *the* tonic, get Sanatogen, the food-tonic. It's the one tonic universally acclaimed by the medical profession, the one tonic built on scientific principles, the one tonic of real, lasting merit, the one tonic that "makes good."

Prof. Thomas B. Stillman
The well-known research chemist of Stevens' Institute, writes: "The chemical union of the constituents of Sanatogen is a true one representative of the highest skill in the formation of a product containing phosphorus in the organic phosphate condition, and so combined that digestion and assimilation of Sanatogen are rendered complete with the greatest ease."

Hon. Shelby M. Cullom
U. S. Senator from Illinois, writes:
"I can state that I have been decidedly benefited by the use of your Sanatogen. I consider this preparation very valuable as a reconstructive of the nervous system."

David Belasco
The eminent dramatic author, writes:
"It gives me pleasure to let you know the wonderfully beneficial results I have experienced from the use of your Sanatogen. It has a most invigorating effect upon the nerves and I heartily recommend it to all who, like myself, are obliged to overwork. After my personal experience I can readily vouch for its recuperative qualities."

We ask you earnestly to get acquainted with Sanatogen. Investigate our claims first, if you like, and we are only too glad to have you do so. Ask your doctor about it, and in any case write at once for our book, "Our Nerves of To-morrow," the work of a physician-author, written in an absorbingly interesting style, beautifully illustrated and containing facts and information of vital interest to you. This book also contains evidence of the value of Sanatogen which is as remarkable as it is conclusive.

Sanatogen is sold in three sizes, $1.00, $1.90, $3.60

Get it from your druggist—if not obtainable from him, sent upon receipt of price by

The Bauer Chemical Company, 515 EVERETT BLDG. Union Square, N. Y.

AERONAUTICS

We build scale models to your own design or supply all necessary materials. Drawing and directions for three-foot model Blériot Monoplane; 15 cents. Stamp brings catalog.

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1202 Bedford Ave., Brooklyn, N. Y.

FREE SAMPLE goes with first letter something new. Every firm wants it. Orders $1.00 to $100.00. Nice pleasant business. Write at once
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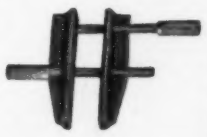

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is not complete without
PARKER'S PRESSED METAL CLAMP

Replaces the antiquated, cumbersome, wood clamp. For mechanics, machinists, wood-workers. Made in 2½ in., 3 in., 3½ in. sizes. Prices, 25c, 35c, 45c, respectively. Mailed post-paid on receipt of price. Special reduction when ordered in quantities. Liberal discount to dealers.

JOHN L. PARKER CO. ***Metal Stampings.*** WORCESTER, MASS.

Twice as Much for Your Tire Money

The demand for Goodyear No-Rim-Cut tires is the year's sensation.

Last year our tire sale trebled—jumped to $8,500,000—because of these patented tires. This year's demand runs over double last year's. Our enormous factories are run night and day, with three shifts of men, to supply it.

This year 64 leading motor car makers have contracted with us for these tires. Over 600,000 Goodyear No-Rim-Cut tires have been sold to date.

The reasons lie here: These patented tires now cost no more than common clincher tires. They used to cost one-fifth more.

They make rim-cutting impossible. They require no tire bolts. They are hookless tires, having no bead to "freeze" into the rim flange.

And, because they are hookless, we can make them 10% oversize. We do it without extra charge. That means 10% extra carrying capacity. With the average car it adds 25% to the tire mileage.

These two features together—No-Rim-Cut and oversize—under average conditions, cut tire bills in two. When they cost the same as old-style tires, do you wonder that users want them?

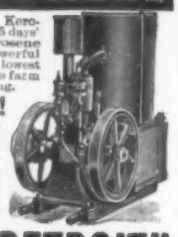
GOODYEAR
No-Rim-Cut Tires
With or Without Non-Skid Tread

Our Tire Book—based on 12 years of tire making—tells many facts you should know. It will make you forever a convert to Goodyear No-Rim-Cut tires. Ask us to mail it to you.

THE GOODYEAR TIRE & RUBBER COMPANY, First Street, AKRON, OHIO
Branches and Agencies in 103 Principal Cities *We Make All Sorts of Rubber Tires*
(317) **Canadian Factory: Bowmanville, Ontario** Main Canadian Office: Toronto, Ontario

Use KEROSENE Engine FREE!

Amazing "DETROIT" Kerosene Engine shipped on 15 days' FREE Trial, proves kerosene cheapest, safest, most powerful fuel. If satisfied, pay lowest price ever given on reliable farm engine; if not, pay nothing.



Gasoline Going Up!

Automobile owners are burning up so much gasoline that the world's supply is running short. Gasoline is to be higher than coal oil. Still going up. Two pints of coal oil do work of three pints gasoline. No waste, no evaporation, no explosion from coal oil.

Amazing "DETROIT"

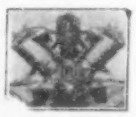
The "DETROIT" is the only engine that handles coal oil successfully; uses alcohol, gasoline and benzine, too. Starts without cranking. Basic patent—only three moving parts—no cams—no sprockets—no gears—no valves—the utmost in simplicity, power and strength. Mounted on skids. All sizes, 7 to 20 h.p., in stock ready to ship. Complete engine tested just before crating. Comes all ready to run. Pumps, saws, threshes, churns, separates milk, grinds feed, shells corn, runs home electric-lighting plant. Prices (stripped), $29.50 up. Sent any place on 15 days' Free Trial. Don't buy an engine till you investigate amazing, money-saving, power-saving "DETROIT." Thousands in use. Costs only postal to find out. If you are first in your neighborhood to write, we will allow you Special Extra-Low Introductory price. Write!

Detroit Engine Works, 127 Bellevue Ave., Detroit, Mich.

You Can Now Purchase

A Complete Curtiss Power Plant With a Genuine Curtiss Motor and Propeller.

Curtiss power plants have been tried, tested and proven. When you buy one, it relieves you of all worry on this part of the equipment. In other words, it assures the success of your aeroplane. No experimenting or thought on your part is necessary—it has all been done for you by skilled experts. You receive the finished, perfected product.



Curtiss Aeroplane Motor

Model "A" 4 cylinder, 25 H.P.
Model "B" 8 " 60 "

Propeller, radiator and equipment especially designed for each motor.

Descriptive circular "A" for the asking.

THE CURTISS MOTOR CO.
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Under the auspices of the American Aeronautical Society. Technical and Practical training for the Aviator, Designer and Inventor. Send for particulars

M. E. KASMAR, Secretary
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3 h.p. Gile Boat Engine $42

Bronze Propeller and Stuffing Box included

30-Day Trial

Famous on the Great Lakes and both Coasts. Guaranteed as specified, or money refunded. Catalogue gives every detail of materials and build, and tells why we sell so low. Write for it and testimonials. Equally low prices on 5, 6, 10, 15 h.p.

Special Offer to Demonstrators

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4 H.P STATIONARY GASOLINE ENGINE $76.00

12 H.P. $219

For Farmwork, Irrigation or Pumping, Factory use and Electric Lighting.

1½ to 36 h.p.—perfectly governed—guaranteed by a responsible firm. Write for particulars.

Gray Motor Co. 537 Charlotte Ave., Detroit, Mich.

WATER SUPPLY and Electric Lighting Plants FOR COUNTRY HOUSES

No elevated tank to freeze or leak. Tank located in cellar. Sixty lbs. pressure. Furnished with Hand, Gasoline or Electric Pump. Ideal Fire Protection. ELECTRIC LIGHTING PLANTS at prices within the reach of all. Write for Catalogue "E."

LUNT-MOSS COMPANY
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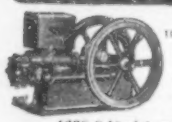
WITTE ENGINES



Gas—Gasoline—Distillate

Horse-power at one cent per hour average; saves fuel, repairs and time. Cheapest of all powers.

Guaranteed Five Years

Special price to introduce in new localities. Write for catalog stating size wanted.

WITTE IRON WORKS CO.
1608 Oakland Avenue, Kansas City, Missouri

The Holtzer-Cabot Variable Speed Dynamo

Combined with the

NEW EDISON STORAGE BATTERY

Furnishes the best and most efficient lighting system extant for Automobiles and Power Boats. No indicators, relays or other instruments required.

Send for Booklet 5811

The Holtzer-Cabot Electric Co.
Brookline, Mass. Chicago, Ill.

Running Water in the Country Home Without Fuel Cost

A pumping engine costs you money or fuel every minute it runs—a windmill runs only when there is wind—both constantly require repairs—but, the

Niagara Hydraulic Ram

constantly pumps water 24 hours a day, without cost of fuel, your other power without necessity of repairs. Write at once for catalogue. All sizes and guaranteed entirely.

NIAGARA HYDRAULIC ENGINE CO.
750 Bond Bldg., Phila. Factory, Chester, Pa.

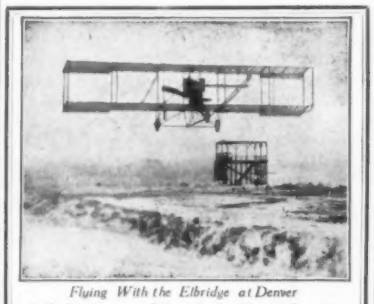
"Parseval VI.," after six months of successful continuous service, was incurred not in the air, but on the ground.

The failure to provide docking machinery and the tendency to rely entirely upon muscular power are easily explained. The first dirigibles were small, so small that a few men could handle them with comparative ease. When it was found that the increase in size meant increase in efficiency, and when, accordingly, the airship began to grow, no effort was made to improve upon the primitive methods of docking, although time and time again they have proven themselves inadequate. It was pointed out in these columns that an airship should be moored to an anchoring tower, around which it can swing with the wind, as unhampered as a weather vane, and from which it could drift away when starting, and to which it could be moored again by dropping a rope from above. But so long as airships are compelled to enter a long shed, which is nothing more or less than an elongated dog kennel, the problem will be difficult to solve. If we must adhere to the shed, why is it not possible to lay a subterranean track along the central line of the shed, and extending out into the open for a sufficient distance from the doors at both ends? Why should it not be possible to permit the airship to alight upon a train of cars, running upon these tracks? Why should it not be possible to withdraw the airship from its shed on the same train of cars, and to release simultaneously the fastenings that hold each section of the ship to each car? This scheme is not chimerical. Indeed, it may even be said to have been carried out; for the long rafts upon which the early Zeppelins were drawn from their floating sheds on Lake Constance were the equivalent of such a train of cars. To facilitate landing, the outer ends of the track should branch out into a fan, like the switch tracks of a round-house, so that one track, at least, will always lie in the direction of the wind. After the bow anchor-cable is hooked to the first car of the train on the track, the hull would swing spontaneously into line with the other cars and settle down easily. If an airship is to land safely, it must land at some distance from its shed, so that the possibility of the wind's pounding it against a large wooden wall or roof is avoided.

What happened to the "Deutschland" would happen to the "Lusitania" if she had to moor in a space not much wider than her hull between two walls that ended in the surf of a rocky shore. The sides of an airship shed are as dangerous to a "Deutschland" as the cliffs of a rocky coast. Compared with the entering of a shed in the wind, an enforced landing in the open is safe.

The truth of these statements is borne out by the peculiar accident that happened to the military Parseval of the fortress of Cologne. Some time ago, that vessel was shipped to Bitterfeld to be overhauled. After the overhauling was finished a trial flight was made, which was very successful. While the airship was being docked a violent wind cast it against its shed, and tore such a huge hole in the envelope that the gas rushed out immediately, for lack of cellular divisions such as those to be found in the Zeppelins. The ship dropped so suddenly and violently that the men on board had reason to be thankful that they were not higher. As it was, the fall of thirty feet was enough to injure two of the crew, although but slightly.

Highest Barometric Pressure Ever Observed in Europe.—Meteorological reports from European Russia show that an anticyclone of unprecedented intensity prevailed over the eastern portion of that country on November 26th and 27th, 1910. At several stations the barometric pressure (reduced to sea level and standard gravity) exceeded 800 millimeters (31.50 inches), thus breaking the European record established by the remarkably high pressure of January, 1907, in the same region. At Katharinenburg, at 7 A. M., November 26th, the barometer (corrected and reduced as stated above) read 800.7 millimeters (31.524 inches), the highest pressure ever recorded at a European station. The anticyclone was accompanied by destructive wind storms over the Black, Caspian and Azof seas.



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All climatic conditions look alike to the man who uses an Elbridge Motor in his aeroplane

Many professionals have failed to fly at Denver, owing to its altitude and dry, rare atmosphere. Elbridge engines have been used in countless successful flights in this city. It does equally well at the sea level and in heavy moist air. Catalog Free.

"American Amateur Aviation," a history of 1910 amateur achievements sent for six cents

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¶ If you want a complete text book on **Solders** and the art of **Soldering,** giving *practical, working* recipes and formulæ which can be used by metallurgist, the goldsmith, the silversmith, the jeweler, and the metal-worker in general, read the following *Scientific American Supplements:* 1112, 1384, 1481, 1610, 1622, 1434, 1533, price 70 cents by mail. ¶ Order from your newsdealer or from

MUNN & COMPANY, *Inc.*
Publishers, 361 Broadway, New York

American Homes & Gardens *for* June

A Summer Home and Its Furnishings Complete for $1,000

¶ In the June issue of American Homes and Gardens there will appear from the pen of the well-known author on House Furnishing and Decoration, Miss Alice M. Kellogg, an article, which tells how it is possible to obtain a summer home and its furnishings for the ridiculously small sum of $1,000. That is not all. The article, which is fully illustrated, shows how the house can be completely furnished, with the cost of each article. Would you believe that the amount named above includes the entire cost of furnishing? This is no fairy tale. The article specifies the cost of the house, and it also gives the exact cost of each piece of furniture, curtains, draperies, the rugs which are to cover the floors, china for table use and the kitchen utensils. The article is profusely illustrated, so that the reader can judge for himself whether the parts described appeal to his particular taste.

No family planning for an inexpensive summer outing should fail to send for this interesting issue. No article has ever been published which provides for so much at so little expense. It deals with facts and figures, and no one is better fitted to speak on the subject with greater authority than this expert. The issue also contains a large number of other articles on divers subjects, all of interest to the practical man or woman who is interested in country life in its broadest sense.

Copies of American Homes and Gardens can be purchased from the newsstands and from the publishers. Price twenty-five cents. Subscribe now for the year, and receive the thirteen issues, from July, 1910, to July, 1911, for the full subscription price of $3.00 for one year. MUNN & CO., Inc., Publishers, 361 Broadway, New York, N. Y.

¶ Any one desiring to order the full equipment described in the text of Miss Kellogg's article can do so by addressing the Editor of American Homes and Gardens at the above address. There will be no charge made for attending to such orders.

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is always on the job. It contains more up-to-date, accurate, money saving information on reinforced concrete, irrigation, water supply and water power development than you can get in any other book or set of books. It is especially adapted

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If you will send us your name and address on coupon below, we will send you a complete set of these books by prepaid express. You can keep them in your home five days. Examine them carefully, apply the information they will give you to your daily needs. If you think they will help you in your work, send us $2.00, then $2.00 every thirty days until the special price of $24.00 has been paid. The regular price is $48.00. If the books are not what you want, advise us. We will have them returned at our expense.

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SPECIAL PREPAID OFFER

Sci. Am. 5-27-11 A. S. of C.

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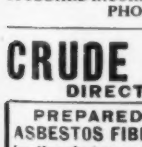

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Aeronautics

A Beginner Killed at Los Angeles.—An unusual aeroplane accident occurred at Los Angeles on May 17th, as a result of which A. V. Hardle of Marseilles, O., lost his life. Hardle was a beginner who had made his first flight in a biplane only the day before. He was warned by his instructor not to be so hasty, but he persisted in trying to make a big flight without the proper experience. As a result he fell from a considerable height and was instantly killed.

A Double Aeroplane Fatality in France.—On May 18th, at Rheims, France, a monoplane driven by Pierre Marie Bournique, the R. E. P. pilot who made some excellent speed and distance records at the end of last year, and whose portrait we published in our recent Aviation Number, plunged to the ground from a height of some 200 feet, instantly killing Lieut. Paul Dupuis, the passenger, and so badly injuring the aviator that he died soon after the accident. That the motor had not been stopped when the machine struck the ground seems to be shown from the fact that the gasoline caught fire instantly, thereby incinerating the body of Lieut. Dupuis. Bournique was thrown clear of the machine. According to cable reports, the monoplane capsized as the result of a bad wind gust, but this is improbable, as the R. E. P. is one of the best and steadiest flyers. It is more likely that something went wrong with the controls.

The Cause of Lieut. Kelly's Fatal Aeroplane Accident.—That Lieut. George E. Kelly lost his life at San Antonio, Tex., on May 10th, in an attempt to avoid falling upon the soldiers there encamped, is brought out by the army board that investigated the accident, and which consisted of First Lieut. P. N. Beck, First Lieut. B. D. Foulois and Second Lieut. John C. Walker, Jr., as follows: "After striking the ground the first time the machine bounded to a height of approximately 10 feet, gradually rising to about 30 feet, until within 75 yards of the camp of the Eleventh Infantry. It made a sharp turn to the left and made an abrupt dive to the ground. Lieut. Kelly was thrown clear of the machine to a distance of about 20 feet. As a result of the first impact with the earth it is apparent that the pilot lost control of the front elevator control. From all these preceding facts the board is of the unanimous opinion that the accident was due to the efforts of Lieut. Kelly to avoid endangering the occupants of the Eleventh Infantry camp, in which endeavor it became necessary for him to make a sharp left turn which, in the crippled condition of the machine, brought more strain on the controls than would have been required in a straightaway landing. Such straightaway landing was impracticable, owing to the proximity of the tents."

Accident to "Deutschland II." and Other Airships.—The dirigibles have latterly been having about as many accidents as the aeroplanes. When the number of airships in use is compared with the number of aeroplanes, the accidents to the former are out of all proportion, but, on the other hand, in the dirigible accidents the passengers and crew generally come out unscathed. The latest and largest airship to come to grief is the large Zeppelin "Deutschland II." Just as she was almost out of her shed at Düsseldorf on the 16th instant, a heavy gust of wind banged her back against it, tore off the outer envelope, and burst a couple of the twenty-odd balloons. Withdrawn by another whirl of wind, despite the efforts of 200 men, the leviathan rose slightly and then fell across the roof of the shed, breaking her back. The crew and eight passengers—four men and four women—were rescued by a fire brigade, unharmed. Within a few days of this accident the British Lebaudy military dirigible was so badly damaged in a similar manner that it is doubtful whether it will ever be repaired. In addition to this, the new 510-foot English naval airship No. 1 met with an accident while being assembled; and on May 17th the Parseval II. was blown against her shed at Bitterfeld and wrecked at the end of a trial trip. This accident was an exception from the fact that two passengers suffered sprained ankles.

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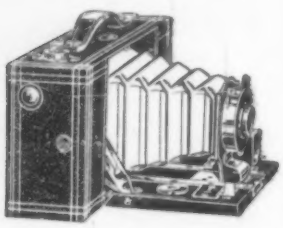

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Engineering

Latest Type of Scout Cruisers.—The latest type of scout cruiser of the British navy, the "Dartmouth," is of 5,250 tons, carries eight 6-inch guns, and will probably have a speed of 26 to 27 knots. The scouts, like every other type of warship, are increasing rapidly in size.

Seamless Tubes from Pierced Billets.—In making seamless tubes from pierced, round steel billets, the latter are heated, cut into lengths of 22 to 35 inches, reheated and pierced by soft iron plugs, and roughed down into tubes 8 to 11 feet long, all in one heat. After reheating, the tubes are rolled in the finishing mill into tubes from 11 to 14 feet long.

Great Britain's Naval Program.—The naval estimates for Great Britain call for a total expenditure of $220,000,000 for the year 1911 to 1912. There is to be a total increase of 3,246 men, 35 commissioned officers, and 149 warrant officers. Five large armored ships are to be built, three protected cruisers, one unarmored cruiser, twenty destroyers, six submarines, and a few smaller craft.

Steamship Salved by Compressed Air.—Another steamship has been raised by the Arbuckle compressed air method, which has been described in the SCIENTIFIC AMERICAN. This time the vessel was the "Soperga," an Italian ship which went ashore on Molasses Reef on her way from New York to Galveston. The apparatus was applied April 29th, and on May 6th the vessel was afloat.

Scientific Management at Navy Yards.—H. L. Gantt, Harrington Emerson and Charles Day, experts in scientific management, have visited the principal Eastern navy yards, at the request of Secretary Meyer, for the purpose of giving suggestions for improving the management of manufacturing and repair shops along the lines which have given such good results in railroad and industrial establishments.

Barge Canal Terminals.—A conference of commercial bodies throughout the State of New York interested in the Barge Canal has agreed upon a plan for terminals, which will cost $18,600,000 to carry out. The bill provides that any city or village along the canal may petition for terminal facilities, which petition will be passed upon by the State Superintendent. About 100 representatives from points contiguous to the canal were present at the conference.

Fictitious Danger in Oiled Roads.—The city officials of South Norwalk are stated to be about to stop the system of oiling the roads; this decision being based on a recent trolley accident, which was said to be due to the greasy condition of the rails as the result of road oiling. In view of the great benefits derived from the system, we think that a decision to abandon it should be based on more extended evidence than was at the disposal of the South Norwalk officials.

Date of Panama Canal Completion.—As the depth of the Culebra cut at Panama increases and its width narrows, the number of shovels that can be employed, and therefore the total output per month, will decrease. Allowing however for this, it is evident that the great cut will be completed by January 1st, 1913. At Gatun the concreting of the upper locks is 95 per cent completed; 50 per cent has been laid in the middle locks, and the greater part of the floor of the lower lock has been covered with concrete. These locks and the great Gatun dam should also be finished by January 1st, 1913.

Electric versus Steam Locomotives.—The chief electrical engineer of the New Haven Railroad, in a recent paper on the electrical operation of that system, speaking of the reduction of delays in the service due to electrical operation stated that eighteen months after commercial service was inaugurated, the electrical-failure report showed a record of over 15,700 miles per engine failure. Between November 2nd and 23rd, 1909, 66,000 electric locomotive miles were run (about equal to eleven round trips from New York to San Francisco) with a total of three minutes' delay. Summing up, he finds that in respect of delays, the electric service is 133 per cent better than steam service.

Electricity

New Electric Milking Machine.—Apparatus for milking cows by means of a partial vacuum have been used for a number of years. In a new form of milking machine just invented by a Swedish engineer, pressure instead of suction is employed, so that the act of milking is similar to that of the hand operation. The device consists of a set of rubber-covered plates which are made to press the teats by means of suitable mechanism driven by a small electric motor. The current required to drive the machine is less than half an ampere.

Award of the Edison Medal.—The Edison Gold Medal, which is awarded annually to residents of the United States and Canada "for meritorious achievement in electrical science, electrical engineering, or electrical arts," has been granted this year to Frank Julian Sprague, the well-known inventor of the multiple-unit control system in electrical transportation. The medal was awarded at the annual meeting of the American Institute of Electrical Engineers. This is the second medal given by the Institute. The first one was presented last year to Prof. Elihu Thomson.

Protecting Tungsten Street Lamps.—The City Lighting Company of Lawrenceville, Ill., has recently experienced trouble with its series-connected tungsten street lamps, owing to the breaking of filaments on windy days. To overcome this difficulty, the company is now supplying the lamps during the daytime with enough current to heat the filaments just under a red heat, so that they will be less brittle. This method of rendering the filaments ductile is employed only on windy days. The same system is in use on railroad lighting systems, where the lamps must necessarily be subjected to a great deal of jarring. In the case of the Lawrenceville street lamps, it was decided to employ this method of protecting the filaments, largely for the reason that in case of the failure of a single lamp all the rest of the series would be put out of commission, which condition would not be discovered until night-time, when the lighting current was turned on.

Boston-Washington Telephone Conduit.—In order to avoid the repetition of such a disaster as occurred to the telephone and telegraph lines about Washington at the time of President Taft's inauguration, an underground cable route has been under construction, which when completed will connect Washington with Boston. About half of the line running from Boston to New York is completed. The section between New York and Philadelphia has been in service for some time, and that between Washington and Wilmington was built last fall. The cables will contain 74 pairs of copper wires, and by phantoming it will be possible to carry on 99 telephone conversations and send 296 different telegraphic messages through them at the same time. On the section between Philadelphia and Washington there will be nearly 10,000 Pupin coils. The ditch for the cable has been dug largely by means of trench machines. At frequent intervals manholes are provided, built of concrete slabs with concrete covers.

Artificial Daylight.—A recent number of the *Electrical World* contains a study of artificial daylight by Messrs. H. E. Ives and M. Luckiesh. They have endeavored to produce a "daylight window" with tungsten lamps by subtracting from the light emitted by the tungsten filament some of the excess yellow and red rays. This they have succeeded in doing by using glass screens of cobalt blue and signal green, together with a gelatine film containing a certain amount of dye. To be sure, this resulted in reducing the light efficiency considerably. The consumption was ten to twelve watts per candle-power. Six 60-watt frosted-tip tungsten lamps were used in a tin box 16x12 x20 inches. The bottom of the box consisted of two glasses, one coated with the gelatine film, and the other being rough-surfaced, so as to act as a diffuser. This gave an illumination of about 30 candles, and the approximation of daylight was exceptionally good. By its use colors could be matched as well as in daylight.

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Science

Remarkable Journey of a Toy Balloon.—A correspondent of *Cosmos* describes the remarkable journey performed by a paper balloon, such as may be obtained from the toy shops, which he sent up, with a postal card attached, on Sunday, February 26th, at Tourcoing (Nord). Two days later the card was returned from Cornimont (Vosges), 415 kilometers (258 miles) distant, with a note indicating that the journey to the latter point had been accomplished in 2 hours and 45 minutes; i. e., at the rate of about 94 miles an hour. A northwest gale was blowing at the time.

A New Meteorological Service in Africa.—The Belgian government is endeavoring to exploit on scientific principles its vast African colony, Belgian Congo. From the *Bulletin Agricole du Congo Belge* we learn that a thorough study of the climate of this territory is to be undertaken, as an indispensable preliminary to its industrial and agricultural development. The country has been divided into sections two degrees square, in each of which at least one meteorological station will be established. The *réseau* will include two or three stations of the first order, where all classes of meteorological observations will be made. Such a station has been maintained at Banana, near the mouth of the Congo River, for some fifteen years, but the greater part of the Congo territory is unknown, climatically.

The Climate of South Africa.—The *Quarterly Journal* of the Royal Meteorological Society for January publishes an interesting description of the climate of South Africa, from the pen of R. T. A. Innes, director of the Transvaal Observatory. In spite of the large extent of territory embraced within the Union, its climate is remarkably even, and is in the fullest sense a temperate one. The average rainfall for the whole of the Union is about 23 inches, but the northwestern part is practically rainless. Abundance of sunshine is, on the whole, the most striking characteristic feature of the country. The climate may be briefly described as genial, exhilarating, sunny and dusty, though intense dust-storms are infrequent. Snow is not uncommon in Basutoland and parts of Cape Colony, but is rare in the Transvaal. The Orange River and Transvaal provinces suffer from destructive hailstorms.

Intensive Climatography.—This term may be applied to a class of scientific literature that is popular in Europe but almost unknown on this side of the Atlantic. Students at the European universities not infrequently choose as the subject of their academic theses the climate of some particular town or other small geographic unit, and discuss the whole available body of meteorological observations in an elaborate and well-nigh exhaustive manner. Sometimes an even higher degree of specialization is preferred, and the entire thesis is devoted to the history and analysis of a single meteorological element at a single station. Such a work comes to us from the University of Basel, where Walter Strub has chosen as the subject of his doctorate dissertation the temperature observations made in that city from the year 1826 to the present time. His work on this relatively narrow subject extends to 140 octavo pages. It is commended to the attention of students in our own universities who are casting about for virgin fields of investigation. There are many places in the United States at which meteorological observations have been made regularly for a long enough period to serve as the basis of a similar discussion; in some cases they extend back over a century or more. Yet Dr. Fassig's work on the climate of Baltimore, published a few years ago by the Maryland Weather Service, is the unique example of the treatment of the meteorology of an American city on a scale comparable to that of the numerous works pertaining to places abroad. Such discussions possess more than a theoretical interest; the establishment of the normal climatic statistics of a particular place is a matter that concerns the municipal engineer, the hygienist, the architect, the electrician engaged in light and power production, etc.

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